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Aerospace Medicine and Biology
A Continuing Bibliography with Indexes

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 328)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in September 1989 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 104 reports, articles and other documents announced during September 1989 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA).* The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR,* including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1989 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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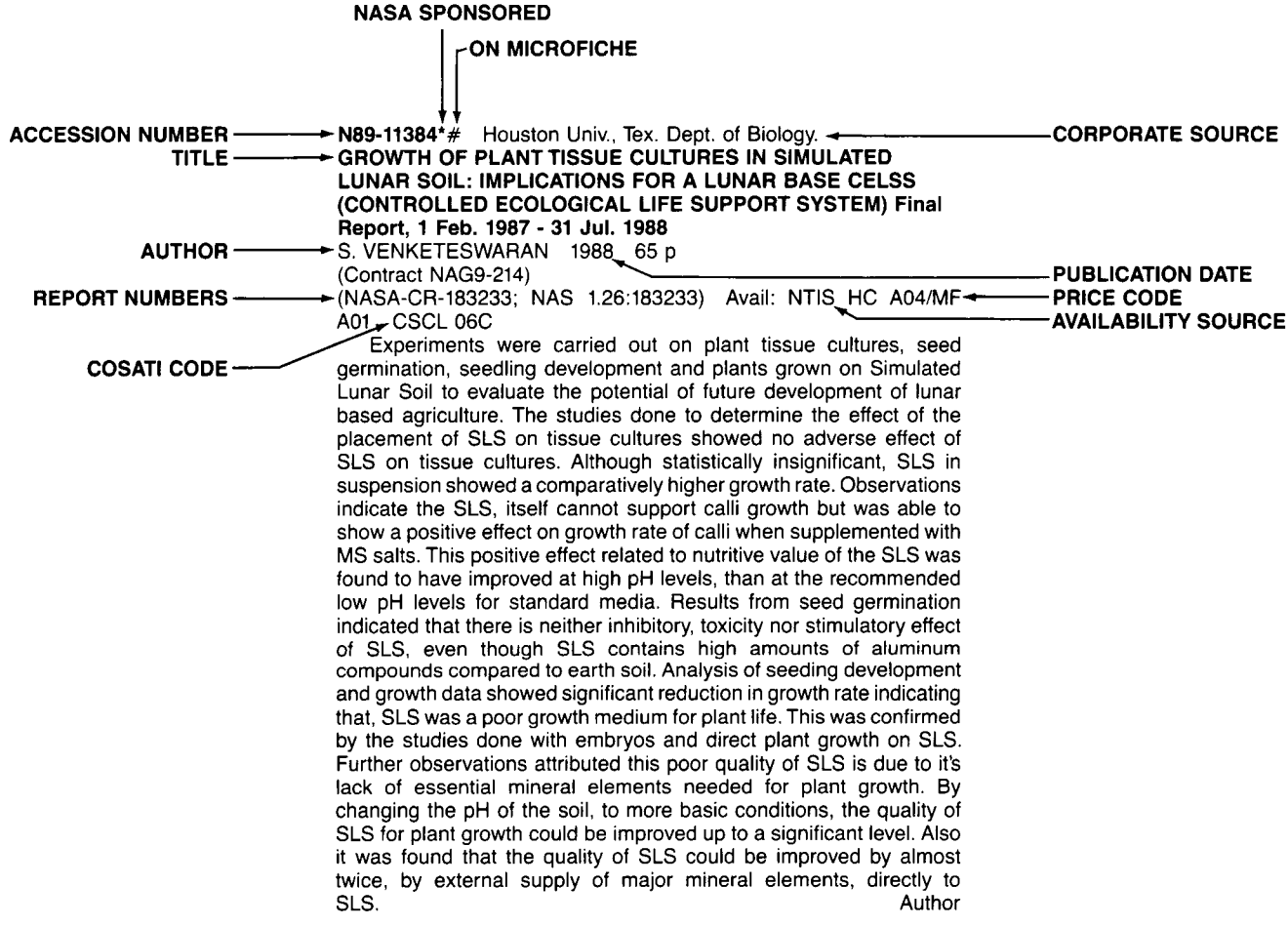
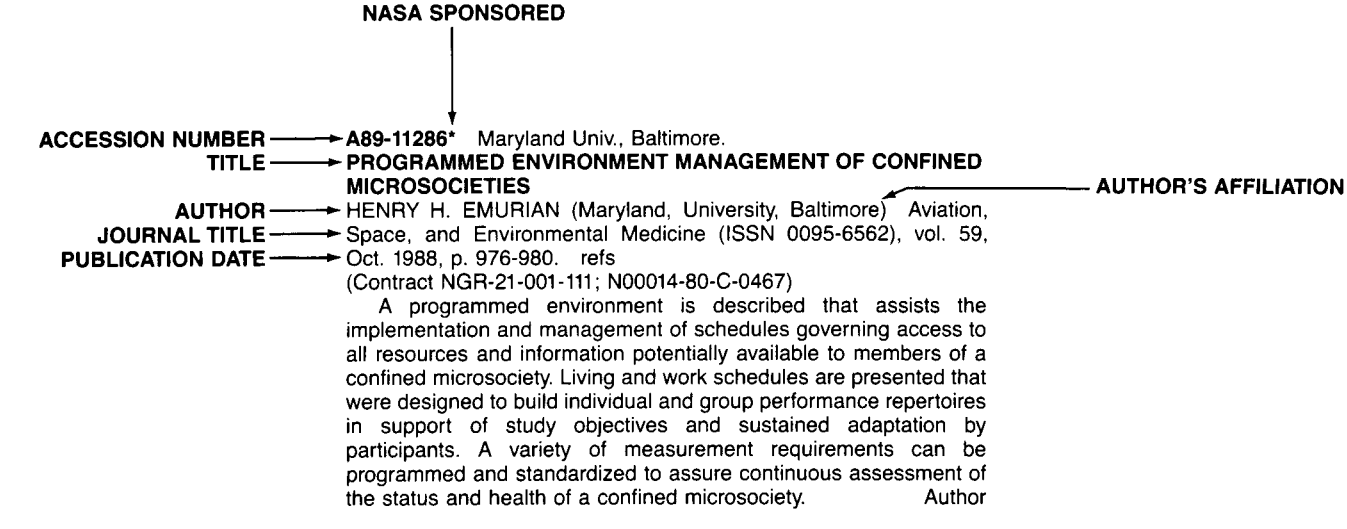
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 328)

OCTOBER 1989

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LIFE SCIENCES (GENERAL)

A89-40118
STRUCTURE AND FUNCTION OF BACTERIAL PHOTOSYNTHETIC REACTION CENTRES
G. FEHER, J. P. ALLEN, M. Y. OKAMURA (California, University, La Jolla), and D. C. REES (California, University, Los Angeles) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 111-116. Research supported by NSF and NIH. refs

The recent determination of the crystal structures of the reaction centers of two photosynthetic bacteria is used here to investigate quantitatively the primary electron transfer processes of photosynthesis. The three-dimensional structure of the reaction centers and the electronic structure of the cofactors are described. The structure-electron transfer relationship is elucidated. C.D.

A89-40124
ORIGIN OF THE ALGAE
ROLAND PERASSO, ANNE BAROIN, ANDRE ADOUTTE (Paris XI, Universite, Orsay, France), LIANG HU QU, and JEAN PIERRE BACHELLERIE (Toulouse III, Universite, France) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 142-144. Research supported by CNRS, Universite de Paris XI, and Universite de Toulouse III. refs

Partial sequences of the large (28S) cytoplasmic ribosomal RNA from 10 new species of protists belonging to various groups of unicellular algae are analyzed. By combining them with the homologous sequences from 14 other unicellular and multicellular eukaryotes, it is shown that rhodophytes, chromophytes, and chlorophytes emerge as three distinct groups late among eukaryotes, that is, close to the metazoa-metaphytes radiation. This implies a relatively late occurrence of eukaryotic photosynthetic symbiosis. Details of intra- and interphyla relationships are provided. C.D.

A89-40125
PHYLOGENETIC ANALYSIS BASED ON RRNA SEQUENCES SUPPORTS THE ARCHAEBACTERIAL RATHER THAN THE EOCYTE TREE
MANOLO GOUY (Texas, University, Houston; Lyon I, Universite, Villeurbanne, France) and WEN-HSIUNG LI (Texas, University, Houston) Nature (ISSN 0028-0836), vol. 339, May 11, 1989, p. 145-147. Research supported by NIH. refs

A89-40877
RNA-PROTEIN INTERACTIONS IN 30S RIBOSOMAL SUBUNITS - FOLDING AND FUNCTION OF 16S RRNA
SETH STERN, TED POWERS, HARRY F. NOLLER (California, University, Santa Cruz), and LI-MING CHANGCHIEN (Wisconsin, University, Madison) Science (ISSN 0036-8075), vol. 244, May 19, 1989, p. 783-790. refs
(Contract NIH-GM-17129; NSF DMB-85-21802)

Chemical probing methods have been used to 'footprint' 16S ribosomal RNA (rRNA) at each step during the in vitro assembly of twenty 30S subunit ribosomal proteins. These experiments yield information about the location of each protein relative to the structure of 16S rRNA and provide the basis for derivation of a detailed model for the three-dimensional folding of 16S rRNA. Several lines of evidence suggest that protein-dependent conformational changes in 16S rRNA play an important part in the cooperativity of ribosome assembly and in fine-tuning of the conformation and dynamics of 16S rRNA in the 30S subunit. Author

A89-40924
HOW OLD IS THE GENETIC CODE? STATISTICAL GEOMETRY OF TRNA PROVIDES AN ANSWER
MANFRED EIGEN, BJOERN F. LINDEMANN, MANFRED TIETZE, RUTHILD WINKLER-OSWATITSCH (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen, Federal Republic of Germany), ANDREAS DRESS (Bielefeld, Universitaet, Federal Republic of Germany) et al. Science (ISSN 0036-8075), vol. 244, May 12, 1989, p. 673-679. refs

The age of the molecular organization of life as expressed in the genetic code can be estimated from experimental data. Comparative sequence analysis of transfer RNA by the method of statistical geometry in sequence space suggests that about one-third of the present transfer RNA sequence divergence was present at the urkingdom level about the time when archaebacteria separated from eubacteria. It is concluded that the genetic code is not older than, but almost as old s our planet. While this result may not be unexpected, it was not clear until now that interpretable data exist that permit inferences about such early stages of life as the establishment of the genetic code. Author

A89-40971
THE INTRINSIC ELECTROPHYSIOLOGICAL PROPERTIES OF MAMMALIAN NEURONS - INSIGHTS INTO CENTRAL NERVOUS SYSTEM FUNCTION
RODOLFO R. LLINAS (New York University, Medical Center, NY) Science (ISSN 0036-8075), vol. 242, Dec. 23, 1988, p. 1654-1664. refs

This article reviews the electroresponsive properties of single neurons in the mammalian central nervous system (CNS). In some of these cells the ionic conductances responsible for their excitability also endow them with autorhythmic electrical oscillatory properties. Chemical or electrical synaptic contacts between these neurons often result in network oscillations. In such networks, autorhythmic neurons may act as true oscillators (as pacemakers) or as resonators (responding preferentially to certain firing frequencies). Oscillations and resonance in the CNS are proposed to have diverse functional roles, such as: (1) determining global functional states (for example, sleep-wakefulness or attention), (2) timing in motor coordination, and (3) specifying connectivity during development. Also, oscillation, especially in the thalamo-cortical circuits, may be related to certain neurological and psychiatric disorders. This review proposes that the autorhythmic electrical properties of central neurons and their connectivity form the basis for an intrinsic functional coordinate system that provides internal context to sensor input. Author

A89-41017
OXYGEN, OZONE, AEROSOLS AND ULTRAVIOLET EXTINCTION IN GEOLOGICAL TIMES

RASHMI PAUL, A. K. SAHA (National Physical Laboratory of India, New Delhi), and T. BANERJEE (Council of Scientific and Industrial Research, Publications and Information Directorate, New Delhi, India) Indian Journal of Radio and Space Physics (ISSN 0367-8393), vol. 16, Oct. 1987, p. 331-334. refs

An attempt is made at some quantitative estimation of solar ultraviolet extinction during geological times as combined absorbing (and scattering) effect of ozone and aerosols. Based on some atmospheric oxygen growth models, ozone levels are estimated, whereas aerosol levels are inferred from volcanic ash deposit records. It would appear that ultraviolet dosages at ground level should have generally remained below harmful limits throughout the geological period of the last 600 million years. Influence of biology and ecosystems may, however, have been possible with sudden decrease of ozone, caused by events like a supernova explosion, not too far away from the sun. Author

A89-41113
MAGNETOFOSSIL DISSOLUTION IN A PALAEOMAGNETICALLY UNSTABLE DEEP-SEA SEDIMENT
HOJATOLLAH VALI (Muenchen, Technische Universitaet, Munich, Federal Republic of Germany; California Institute of Technology, Pasadena) and JOSEPH KIRSCHVINK (California Institute of Technology, Pasadena) Nature (ISSN 0028-0836), vol. 339, May 18, 1989, p. 203-206. Research supported by NSF and DFG. refs

Results are presented from a high resolution TEM study of 'magnetofossil' bacterial magnetosome remains from clay-rich deep-sea sediments which, for unknown reasons, do not record a stable remanent magnetization. The material studied contains a complex mixture of single-domain magnetic minerals. Since it has been impossible to find authigenic magnetic minerals in the sample, and since the magnetic fraction is dominated by well-preserved magnetofossils, it is suggested that the poor preservation of the magnetization is a result of diagenetic interactions between the magnetofossils and the clay minerals in the matrix. O.C.

A89-41619
FREE-ELECTRON LASERS IN ULTRAVIOLET PHOTOBIOLOGY
THOMAS P. COOHILL (Western Kentucky University, Bowling Green, KY) and JOHN C. SUTHERLAND (Brookhaven National Laboratory, Upton, NY) Optical Society of America, Journal, B: Optical Physics (ISSN 0740-3224), vol. 6, May 1989, p. 1079-1082. Research supported by DOE. refs

The potential uses for a free-electron laser (FEL), tunable in wavelength from 10 to 400 nm, for photobiological experiments is discussed. Inherent problems of cell and molecular absorption, especially in certian regions of the ultraviolet (UV), are addressed. Absorption values for living cells and viruses at selected wavelengths in the UV are tabulated, and a calculation of the flux needed to inactivate mammalian cells is included. A comparison is made of the UV output of a proposed rf-linac FEL with those of a monochromator, a tunable dye laser, and a synchrotron. The advantages of a UV FEL are apparent, especially in the wavelength regions where the cross section for absorption by biological molecules is low, i.e., 300 to 400 nm and 10 to 200 nm. It is apparent that a UV FEL would be an ideal source for a variety of biological studies that use both intact organisms and isolated cells and viruses. Author

A89-41851
GO FORTH AND MULTIPLY?
LANCE FRAZER Ad Astra (ISSN 1041-102X), vol. 1, June 1989, p. 24-29.

The study of reproduction in space is reviewed. Microgravity experiments on amphibian and bird eggs are examined, including the chicken embryo experiment which was flown on the Space Shuttle in March, 1989. The effects of stress, radiation, and microgravity on human reproductive function are discussed. Plans for future studies to determine the effects of space on human reproduction are considered, including the development of the Lifesat program of free-flying satellites to perform life science experiments. R.B.

A89-41860
PROTEROZOIC MICROFOSSILS FROM MANGANESE OREBODY, INDIA
P. C. BANDOPADHYAY (Geological Survey of India, Calcutta) Nature (ISSN 0028-0836), vol. 339, June 1, 1989, p. 376-378. refs

The presence of microfossils from the Proterozoic manganese orebody of the Penganga Group, India, is reported. These microfossils occur commonly in chert and are present within manganese oxide sediments. The microfossils probably have affinities with the Cyanobacteria and may have been planktonic; both coccoid and filamentous forms are present. The presence of these microfossils suggest a possible genetic relationship between microbiota and manganese deposition and provides further information about Proterozoic ecology. C.D.

A89-42405
VARIATION OF CYTOPLASMIC RNA IN THE RAT'S MOTOR CORTEX NEURONS AND CAUDATE NUCLEI DUE TO HYPOKINESIA [IZMENENIE KOLICHESTVA TSITOPLAZMATICHESKOI RNK V NEIRONAKH MOTORNOI KORY I KHVOSTATYKH IADER GOLOVNOGO MOZGA KRYS PRI GIPOKINEZII]
M. D. KALATOZISHVILI (AN GSSR, Institut Fiziologii, Tbilisi, Georgian SSR) Akademiia Nauk Gruzinskoi SSR, Soobshcheniia (ISSN 0132-1447), vol. 133, Feb. 1989, p. 413-416. In Russian. refs

Changes in the amount of cytoplasmic RNA in the rat's motor cortex neurons and caudate nuclei during hypokinesia were investigated using a scanning cytophotometer. The results obtained suggest that changes indicative of a compensatory function of higher nervous system levels develop to different degrees in those areas of the nervous system that are functionally interrelated and are at different levels of phylogenetic development. Details of the experiments and cytoplasmic RNA readings are presented. V.L.

A89-43119#
INCUBATOR FOR CELL CULTURING UNDER MICROGRAVITY [INKUBATOR FUER DIE ZELLKULTIVIERUNG UNTER SCHWERELOSIGKEIT]
OTFRIED JOOP, PETER KERN, and VOLKER STROEBEL Dornier Post (ISSN 0012-5563), no. 3, 1988, p. 40, 41. In German.

Zink, a cell-culture incubator being developed for the second FRG Spacelab mission D2 (scheduled for December 1991), is described. Zink incorporates a 1-g centrifuge and is designed to maintain a temperature of 36.5 + or - 1.0 C for 1-2 weeks; the incubator holds 16 type 1 containers for 1-g experiments or 30 containers for microgravity experiments. Key design parameters include external dimensions 442 x 357 x 612 mm, internal dimensions 400 x 171 x 474 mm, usable volume 32 l, weight 36 kg or less, and electric power consumption 46 W at cabin temperature 24 C or 62 W at 18 C. T.K.

N89-24015*# Florida Univ., Gainesville. Dept. of Engineering Sciences.
ADVANCED SPACE DESIGN PROGRAM TO THE UNIVERSITIES SPACE RESEARCH ASSOCIATION AND THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Final Report, 1987-1988 Academic Year
GALE E. NEVILL, JR. Jun. 1988 264 p
(Contract NGT-21-002-080)
(NASA-CR-180450; NAS 1.26:180450) Avail: NTIS HC A12/MF A01 CSCL 06C

The goal of the Fall 1987 class of EGM 4000 was the investigation of engineering aspects contributing to the development of NASA's Controlled Ecological Life Support System (CELSS). The areas investigated were the geometry of plant growth chambers, automated seeding of plants, remote sensing of plant health, and processing of grain into edible forms. The group investigating variable spacing of individual soybean plants designed growth trays consisting of three dimensional trapezoids arranged in a compact circular configuration. The automated seed manipulation and planting group investigated the electrical and

mechanical properties of wheat seeds and developed three seeding concepts based upon these properties. The plant health and disease sensing group developed a list of reliable plant health indicators and investigated potential detection technologies.

N89-24016*# Florida Univ., Gainesville.
VARIABLE PLANT SPACING
JIM BLEDSOE and LEE WEISS *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 41 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

The goal of this project was to develop a system for varying the spacings between soybean plants as they grow to maximize the number of plants grown in a given volume. The project was studied to aid in the development of NASA's Controlled Ecological Life Support System (CELSS). The resulting design consists of plant trays which are three dimensional trapezoids arranged into circles in a compact geometrical configuration. These circles are stacked together in back to back pairs to form a long cylinder. In each growth tray, plants will be housed in individual containers containing a nutrient delivery system and a plant support mechanism. Between the containers, a half trellis has been designed to space the plants for maximum space efficiency. The design allows for localized seeding and harvesting mechanisms due to the chambers' geometrical configuration. In addition, the components have been designed for ease of cleaning and minimal maintenance. Next semester, the individual components will be constructed and tested to determine the success of the design.
Author

N89-24017*# Florida Univ., Gainesville.
AUTOMATED SEED MANIPULATION AND PLANTING
RAY GARCIA, JAVIER HERRERA, SCOTT HOLCOMB, PAUL KELLY, SCOTT MYERS, MANNY ROSENDO, HERBERT SIVITZ, and DAVE WOLSEFER *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 32 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

Activities for the Fall Semester, 1987 focused on investigating the mechanical/electrical properties of wheat seeds and forming various Seed Planting System (SPS) concepts based on those properties. The Electrical Division of the design group was formed to devise an SPS using electrostatic charge fields for seeding operations. Experiments concerning seed separation using electrical induction (rearranging of the charges within the seed) were conducted with promising results. The seeds, when exposed to the high voltage and low current field produced by a Van de Graff generator, were observed to move back and forth between two electrodes. An SPS concept has been developed based on this phenomena, and will be developed throughout the Spring Semester, 1988. The Mechanical Division centered on SPS concepts involving valves, pumps, and fluids to separate and deliver seeds. An SPS idea utilizing the pressure difference caused by air as it rushes out of holes drilled in the wall of a closed container has been formulated and will be considered for future development. Also, a system of seed separation and delivery employing a combination of centrifugal force, friction, and air flow was considered.
Author

N89-24018*# Florida Univ., Gainesville.
PLANT HEALTH SENSING
ARA MANUKIAN, COLLEEN MCKELVY, MICHAEL PEARCE, and STEPH SYSLO *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 34 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

If plants are to be used as a food source for long term space missions, they must be grown in a stable environment where the health of the crops is continuously monitored. The sensor(s) to be used should detect any diseases or health problems before irreversible damage occurs. The method of analysis must be nondestructive and provide instantaneous information on the condition of the crop. In addition, the sensor(s) must be able to function in microgravity. This first semester, the plant health and disease sensing group concentrated on researching and consulting experts in many fields in attempts to find reliable plant health indicators. Once several indicators were found, technologies that could detect them were investigated. Eventually the three methods chosen to be implemented next semester were stimulus response monitoring, video image processing and chlorophyll level detection. Most of the other technologies investigated this semester are discussed here. They were rejected for various reasons but are included in the report because NASA may wish to consider pursuing them in the future.
Author

N89-24020*# Florida Univ., Gainesville.
AUTOMATED SEED MANIPULATION AND PLANTING
RAY GARCIA, JAVIER HERRERA, SCOTT HOLCOMB, PAUL KELLY, SCOTT MYERS, MANNY ROSENDO, HERBERT SIVITZ, and DAVE WOLSEFER *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 36 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

The Mechanical Division fabricated three seed separators utilizing pressure gradients to move and separate wheat seeds. These separators are called minnow buckets and use air, water, or a combination of both to generate the pressure gradient. Electrostatic fields were employed in the seed separator constructed by the Electrical Division. This separator operates by forcing a temporary electric dipole on the wheat seeds and using charged electrodes to attract and move the seeds. Seed delivery to the hydroponic growth tray is accomplished by the seed cassette. The cassette is compatible with all the seed separators, and it consists of a plastic tube threaded with millipore filter paper. During planting operations, the seeds are placed in an empty cassette. The loaded cassette is then placed in the growth tray and nutrient solution provided. The solution wets the filter paper and capillary action draws the nutrients up to feed the seeds. These seeding systems were tested and showed encouraging results. Seeds were effectively separated and the cassette can support the growth of wheat plants. Problems remaining to be investigated include improving the success of delivering the seeds to the cassette and providing adequate spacing between seeds for the electric separator.
Author

N89-24021*# Florida Univ., Gainesville.
NON-DESTRUCTIVE PLANT HEALTH SENSING USING ABSORPTION SPECTROSCOPY
JIM BLEDSOE, ARA MANUKIAN, MICHAEL PEARCE, and LEE WEISS *In its* Advanced Space Design Program to the Universities Space Research Association and the National Aeronautics and Space Administration 56 p Jun. 1988
Avail: NTIS HC A12/MF A01 CSCL 06C

The sensor group of the 1988 EGM 4001 class, working on NASA's Controlled Ecological Life Support Systems (CELSS) project, investigated many different plant health indicators and the technologies used to test them. The project selected by the group was to measure chlorophyll levels using absorption spectroscopy. The spectrometer measures the amount of chlorophyll in a leaf by measuring the intensity of light of a specific wavelength that is passed through a leaf. The three wavelengths of light being used corresponded to the near-IR absorption peaks of chlorophyll a, chlorophyll b, and chlorophyll-free structures. Experimentation showed that the sensor is indeed measuring levels of chlorophyll a and b and their changes before the human eye can see any changes. The detector clamp causes little damage to the leaf and will give fairly accurate readings on similar locations on a leaf, freeing the clamp from having to remain on the same spot of a leaf for all measurements. External light affects the readings only slightly so that measurements may be taken in light or dark environments. Future designs and experimentation will concentrate on reducing the size of the sensor and adapting it to a wider range of plants.
Author

N89-24022*# General Electric Co., Moffett Field, CA.
GAS-GRAIN SIMULATION FACILITY: FUNDAMENTAL STUDIES OF PARTICLE FORMATION AND INTERACTIONS. VOLUME 1: EXECUTIVE SUMMARY AND OVERVIEW
GUY FOGLEMAN, ed., JUDITH L. HUNTINGTON, ed. (Search for Extraterrestrial Intelligence Inst., Los Altos, CA.), DEBORAH E. SCHWARTZ, ed., and MARK L. FONDA, ed. Mar. 1989 38 p Presented at the Gas-Grain Simulation Facility Experiments Workshop, Sunnyvale, CA, 31 Aug. - 1 Sep. 1987; sponsored by the Exobiology Flight Program
(NASA-CP-10026-VOL-1; A-88256-VOL-1; NAS 1.55:10026-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 06C

An overview of the Gas-Grain Simulation Facility (GGSF) project and its current status is provided. The proceedings of the Gas-Grain Simulation Facility Experiments Workshop are recorded. The goal of the workshop was to define experiments for the GGSF--a small particle microgravity research facility. The workshop addressed the opportunity for performing, in Earth orbit, a wide variety of experiments that involve single small particles (grains) or clouds of particles. The first volume includes the executive summary, overview, scientific justification, history, and planned development of the Facility. A.D.

N89-24023*# General Electric Co., Moffett Field, CA.
GAS-GRAIN SIMULATION FACILITY: FUNDAMENTAL STUDIES OF PARTICLE FORMATION AND INTERACTIONS. VOLUME 2: ABSTRACTS, CANDIDATE EXPERIMENTS AND FEASIBILITY STUDY
GUY FOGLEMAN, ed., JUDITH L. HUNTINGTON, ed. (Search for Extraterrestrial Intelligence Inst., Los Altos, CA.), DEBORAH E. SCHWARTZ, ed., and MARK L. FONDA, ed. Mar. 1989 199 p Presented at the Gas-Grain Simulation Facility Experiments Workshop, Sunnyvale, CA, 31 Aug. - 1 Sep. 1987; sponsored by the Exobiology Flight Program
(NASA-CP-10026-VOL-2; A-88256-VOL-2; NAS 1.55:10026-VOL-2) Avail: NTIS HC A09/MF A01 CSCL 06C

An overview of the Gas-Grain Simulation Facility (GGSF) project and its current status is provided. The proceedings of the Gas-Grain Simulation Facility Experiments Workshop are recorded. The goal of the workshop was to define experiments for the GGSF--a small particle microgravity research facility. The workshop addressed the opportunity for performing, in Earth orbit, a wide variety of experiments that involve single small particles (grains) or clouds of particles. Twenty experiments from the fields of exobiology, planetary science, astrophysics, atmospheric science, biology, physics, and chemistry were described at the workshop and are outlined in Volume 2. Each experiment description included specific scientific objectives, an outline of the experimental procedure, and the anticipated GGSF performance requirements. Since these experiments represent the types of studies that will ultimately be proposed for the facility, they will be used to define the general science requirements of the GGSF. Also included in the second volume is a physics feasibility study and abstracts of example Gas-Grain Simulation Facility experiments and related experiments in progress. Author

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A89-40498
DEPENDENCE OF OPTOKINETIC NYSTAGMUS ON THE WIDTH OF THE VISION FIELD [ZAVISIMOST' OPTOKINETICHESKOGO NISTAGMA OT SHIRINY POLIA ZRENIIA]
V. S. TODOROVA and V. K. POPOV (B'lgarska Akademiia na Naukite, Institut po Mekhanika i Biomekhanika, Sofia, Bulgaria) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 75, March 1989, p. 312-317. In Russian. refs

The effect of the vision field covered by the visual stimulus on the optokinetic response was investigated in normal human subjects. The optokinetic nystagmus (OKN) was elicited by moving vertical gratings of widths ranging from 30 to 170 deg, with a large range of velocities (10-120 deg/sec), and a constant stimulus frequency (0.13 cycle/deg). Results indicate that the parameters of OKN can be changed both qualitatively and quantitatively by changing the width of the stimulus. The optimal OKN was found under conditions of the whole field stimulation. Progressive masking of the periphery caused an OKN reduction whose magnitude was fixed in different stimulus ranges, while eliminating the central stimulation resulted in a complete OKN suppression. The role of the stimulation eccentricity and of the stationary edges in the observed OKN changes is discussed. I.S.

A89-40499
SPECTRAL ANALYSIS OF VESTIBULAR NYSTAGMUS [SPEKTRAL'NYI ANALIZ VESTIBULIARNOGO NISTAGMA]
A. V. TELEZHNIKOV, V. G. BAZAROV, L. A. SAVCHUK, I. A. BELIAKOVA, B. G. KADUK (Kievskii Institut Otolaringologii, Kiev, Ukrainian SSR) et al. Fiziologicheskii Zhurnal (Kiev) (ISSN 0201-8489), vol. 35, Mar.-Apr. 1989, p. 18-23. In Russian. refs

A procedure for the spectral analysis of electronystagmograms obtained by rotary stimulation with the rate of 180 deg/sec was developed, that enables the detection of changes in the frequency characteristics which could be used to diagnose a specific pathological hearing condition. The procedure was applied to test 50 subjects, 10 of whom had normal hearing, 20 of whom had Meniere's disease, and 20 of whom suffered from bilateral neuritis of auditory nerves. It was found that, in the periodograms obtained from subjects with Meniere's disease, the third harmonic was not recorded when the right and the left labyrinths were stimulated. In the case of neuritis, the third or the fifth harmonic was absent. The combinations of the nystagram characteristics seen in the two types of pathological cases suggest that the third harmonic reflects the state of the peripheral area of the vestibular analyzer, while the fifth reflects that of the central area. I.S.

A89-40825
COMPARATIVE STUDY OF ASTRONAUT MOTOR BEHAVIOR DURING GROUND TRAINING (G = 1) AND DURING ORBITAL FLIGHT (G = 0) [ETUDE COMPARATIVE DU COMPORTEMENT MOTEUR DE L'ASTRONAUTE AU COURS DE L'ENTRAINEMENT AU SOL /G = 1/ ET PENDANT LE VOL ORBITAL /G = 0/]
CAROLE TAFFORIN (Toulouse III, Universite, France) L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 135, 1989, p. 87-96. In French. refs

The method of Tafforin et al. (1987) is used to analyze video recordings of the motor behavior of astronauts both during ground training and in orbital flight. Larger variations in orientation (with respect to the longitudinal axis) are noted under microgravity conditions, resulting in a larger repertoire of motor and postural activities. The usual vertical posture with limbs extended noted in gravity is replaced in zero gravity by a diversity of postures in which the limbs are predominantly bent. R.R.

A89-40851
COAGULATION AND FIBRINOLYSIS IN ACUTE MOUNTAIN SICKNESS AND BEGINNING PULMONARY EDEMA
PETER BAERTSCH, ANDRE HAEBERLI, MARIO FRANCIOLLI, EGBERT K. O. KRUITHOF, and P. WERNER STRAUB (Bern, Universitaet; Laboratoire Central d'Hematologie, Lausanne, Switzerland) Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2136-2144. Research supported by the Kommission fuer Sportwissenschaftliche Forschung. refs

The possible relationship between the beginnning of the high-altitude pulmonary edema (HAPE) and the parameters of intravascular coagulation and/or decreased fibrinolysis was investigated in 25 male mountaineers after these spent 6, 18, and

42 h at an altitude of 4559 m, which was climbed from an altitude of 550 m in 24 h. The formation of HAPE was assessed by X-ray. Results indicated that, contrary to previously suggested theory of HAPE development, the in vivo fibrin formation and a decreased fibrinolytic activity did not precede the initiation of HAPE (which was observed in six of the 25 subjects), suggesting that these factors were not involved in the initiation of HAPE. I.S.

A89-40852
OPERATION EVEREST II - MAXIMAL OXYGEN UPTAKE AT EXTREME ALTITUDE
ALLEN CYMERMAN, JOHN T. REEVES, JOHN R. SUTTON, PAUL B. ROCK, BERTRON M. GROVES (U.S. Army, Research Institute of Environmental Medicine, Natick, MA; Colorado, University, Denver; McMaster University, Hamilton, Canada; California, University, La Jolla; Vermont, University, Burlington) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2446-2453. Research supported by the Arctic Institute of North America. refs
(Contract DAMD17-85-C-5206; NIH-HL-14985; NIH-HL-17731)

Maximal oxygen uptake at the height of the Mt. Everest summit was determined in eight male subjects undergoing a simulated ascent to Mt. Everest, in which the barometric pressure in an altitude chamber was progressively reduced over the course of 40 days to the final pressure of 240 torr. The results showed that, under conditions of extreme hypobaric hypoxia, the values of minute respiration volume during maximal exercise were sustained at or near the maximal level measured at the sea level, even though the maximal oxygen consumption was greatly reduced. Subjects with higher values of the maximal oxygen consumption level had higher relative uptakes at the simulated high altitudes. I.S.

A89-40853
OPERATION EVEREST II - ADAPTATIONS IN HUMAN SKELETAL MUSCLE
H. J. GREEN, J. R. SUTTON, A. CYMERMAN, P. M. YOUNG, and C. S. HOUSTON (Waterloo, University; McMaster University, Hamilton, Canada; U.S. Army, Research Institute of Environmental Medicine, Natick, MA; Vermont, University, Burlington) Journal of Applied Physiology (ISSN 0161-7567), vol. 66, May 1989, p. 2454-2461. Research sponsored by the Arctic Institute of North America. refs
(Contract DAMD17-85-C-5206)

The effects of progressive hypobaria (achieved in human subjects by gradual decompression over 40 days in an altitude chamber to a simulated altitude of the Mt. Everest summit) on skeletal muscles enzymes related to adaptation to hypobaria were investigated by analyzing enzymes from tissue samples extracted from the m. vastus lateralis before decompression (SL-1), at 380 and 282 torr, and upon return to sea level (SL-2). It was found that the activities of enzymes representative of the citric acid cycle, beta-oxidation, glycogenolysis, glycolysis, glucose phosphorylation, and high-energy phosphate transfer did not change as the result of decompression. However, after exposure to 282 torr for additional 7 days, reductions were observed in succinic dehydrogenase, citrate synthetase, and hexokinase between SL-2 and 380 torr. Capillarization was found to be increased in both type I and type II fibers between SL-1 and SL-2. The results do not support the hypothesis that extreme hypobaric hypoxia elicits adaptation directed toward maximizing oxidative function at the level of the muscle cell. I.S.

A89-42152* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ORTHOSTATIC RESPONSES FOLLOWING 30-DAY BED REST DECONDITIONING WITH ISOTONIC AND ISOKINETIC EXERCISE TRAINING
J. E. GREENLEAF, C. E. WADE, and G. LEFTHERIOTIS (NASA, Ames Research Center, Moffett Field; U.S. Army, Letterman Army Institute of Research, San Francisco, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 537-542. Research supported by the U.S. Army. refs
(Contract NASA TASK 199-21-12)

The effects of intensive exercise training on tilt tolerance following deconditioning of astronauts were investigated by studying orthostatic responses of 19 subjects who underwent two intensive exercise-training regimens during 30 days of -6-deg head-down bed rest (BR). Subjects were divided into no-exercise control group, and two exercise groups, one performing isotonic (Quinton ergometer) exercises, the other doing isokinetic (Lido ergometer) exercises. A 60-deg head-up tilt test was administered on the control day 1 and BR day 30; the test was terminated at 60 min or when presyncopal signs and/or symptoms occurred. It was found that exercise training did not affect tilt tolerance significantly. I.S.

A89-42154
EVOKED POTENTIAL AND OTHER CNS REACTIONS DURING A HELIOX DIVE TO 360 MSW
RAGNAR J. VAERNES (Norwegian Underwater Technology Centre, Laksevaag, Norway) and DAG HAMMERBORG (Bergen, Universitetet, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 550-557. refs

The relationships between evoked potential changes and the high-pressure nervous syndrome (HPNS) were investigated. Visual and cognitive evoked responses were determined in six experienced saturation divers predive, during a heliox dive to 360 msw, and postdive, and the evoked-response changes were compared with other neuropsychological and neurophysiological results from the dive. It was found that subjects with mild symptoms and signs of HPNS had normal visual evoked responses, while more marked HPNS effects led to significant increases in the visual evoked latency. The evoked latency changes were related to the overall 'impairment' (sign index) and not to the individual cognitive performance tests, indicating that wave-form analysis can be an important tool for analyzing the overall cognitive inpairment in hyperbaric environments. I.S.

A89-42155
PHYSIOLOGICAL AND BEHAVIORAL TEMPERATURE REGULATION OF MEN IN SIMULATED NONUNIFORM THERMAL ENVIRONMENTS BETWEEN 18 AND 30 C
A. R. GWOSDOW and L. G. BERGLUND (Yale University, New Haven, CT) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 558-565. refs
(Contract NIH-ES-00354-17; NIH-ES-07086)

The hypothesis that exposure to nonuniform thermal environments increases thermal strain on the body was investigated. Thermoregulatory responses were measured at 18 and 30 C in six sedentary men in whom nonuniform thermal environments were simulated by altering clothing distribution, i.e., clothing was distributed either symmetrically or asymmetrically over the body surface. It was found that, at 18 C, the asymmetric clothing distribution resulted in a higher esophageal temperature. Mean skin temperatures did not differ with clothing distribution at either 18 or 30 C, but at 18 C, the whole-body thermal sensation was warmer for the asymmetric compared to the symmetric group; this increased perception of warmth was significantly correlated to the difference in skin temperature across the body. I.S.

A89-42156* Pennsylvania State Univ., University Park.
ADAPTATION TO VECTION-INDUCED SYMPTOMS MOTION SICKNESS
ROBERT M. STERN, SENQI HU, MICHAEL W. VASEY, and KENNETH L. KOCH (Pennsylvania State University, University Park and Hershey) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 566-572. refs
(Contract NAG9-118)

The effects of repeated exposures to a rotating circular vection drum on the symptoms of motion sickness and tachygastria in humans were investigated. Subjects were sitting in a drum and were exposed to 15 min baseline (no rotation), followed by 15 min drum rotation at 60 deg/s, and, then, by 15 min recovery.

Gastric myoelectric activity was continuously recorded with the electrogastrogram. Subjects who were exposed to the drum three times with intervals of 4-24 days all showed symptoms of tachygastria and failed to show an amelioration of motion sickness symptoms. On the other hand subjects who had only 48 h between the three sessions of drum exposure, experienced a reduction in motion-sickness symptoms and in tachygastsria upon repeated exposure to the drum, indicating that training effected a symptomatic and physiological adaptation. It is suggested that preflight adaptation to visual-vestibular sensory mismatch may reduce motion sickness in astronauts. I.S.

A89-42157
DEPTH PERCEPTION AFTER PROLONGED USAGE OF NIGHT VISION GOGGLES
JAMES B. SHEEHY (U.S. Navy, Naval Air Development Center, Warminster, PA) and MICHAEL WILKINSON (U.S. Marine Corps, Yuma, AZ) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 573-579. refs

The effect of a prolonged usage of night vision goggles (NVGs) on the depth perception was investigated in 12 helicopter pilots/copilots who were tested for stereoscopic depth perception, lateral and vertical phoria, and contrast sensitivity before and after training flights during which the pilots wore either PVS-5A or AN/AVS-6 NVGs for the duration of the flight. Results indicated that, when monocular cues were present, contrast sensitivity and depth perception did not degrade over the course of the mission. On the other hand, lateral phoria tests demonstrated an average exophoric shift of 1.5 prism diopters for 12 out of the 24 missions. Possible causes for the phoria shift are discussed. I.S.

A89-42158
RECOVERY OF PUPILLOMOTOR FUNCTION AFTER CATARACT SURGERY
DANIEL R. PETERS and LAWRENCE TYCHSEN (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 586-588. refs

To determine the effect of cataract surgery upon pupillomotor function, the pupillary response to light was studied in four subjects who had extracapsular cataract extraction with implantation of an intraocular lens. A video infrared pupillometer was used to record pupillary responses 6-20 weeks after surgery. Nonoperated eyes were compared to operated eyes in each subject. Amplitudes and peak velocities of constriction for operated versus nonoperated eyes differed over a small range (2-14 percent). No evidence of dilation lag or segmental palsy was found in the operated eyes. The latency of constriction was not prolonged. It is concluded that pupillomotor function can be expected to recover in aviators who require routine cataract surgery, and that visual disability due to a poorly dilating or constricting pupil should not be an overriding concern. Author

A89-42159
OBSERVATIONS ON THE NEUROPHYSIOLOGIC THEORY OF ACCELERATION (+GZ) INDUCED LOSS OF CONSCIOUSNESS
JAMES E. WHINNERY (U.S. Navy, Naval Air Development Center, Warminster, PA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 589-593. refs

The characteristics of centrifuge +Gz-induced loss of consciousness (G-LOC) have revealed a specific kinetic pattern of resulting physiologic events. The relationship of these events provides an initial basis for describing the possible neurophysiologic mechanism of G-LOC. A description of G-LOC is developed, which divides the G-LOC episode into specific periods based on the psychophysiologic events that occur. Emphasis is placed on the type of acceleration profile which would be most likely to occur during inflight aerial combat maneuvering in fighter aircraft. The symptoms of myoclonic flail movements and memorable dreams which are observed in association with G-LOC may provide key information for unraveling the neurophysiologic mechanism of G-LOC and subsequent recovery. Author

A89-42439
TESTING FOR IRREGULARITIES OF THE CARDIAC RHYTHM AND CONDUCTION IN FLIGHT PERSONNEL BY MEANS OF A COMBINED FUNCTIONAL TEST [VYIAVLENIE NARUSHENII RITMA SERDTSA I PROVODIMOSTI U LETCHIKOV S POMOSHCH'IU KOMBINIROVANNOI FUNKTSIONAL'NOI PROBY]
E. G. MUKHAMEDOV and V. I. PLAKHATNIUK Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1989, p. 46, 47. In Russian.

A functional test was designed for the detection of irregularities in cardiac rhythm and conduction in otherwise healthy humans, in which subjects are asked to perform deep knee-bends while holding breath. Results of ECGs taken at rest and after the test made it possible to diagnose arrhythmia and cardiogenic blocks in 19 out of seemingly normal 167 subjects, among whom only seven were diagnosed for cardiac arrhythmia before the test. In two of the arrhythmic subjects the combined test induced changes in the character of the arrhythmia. Results of clinical studies indicated that, in eight cases, the arrhythmia and conduction irregularities were caused by infection of nasopharynx and mouth cavity. I.S.

A89-42440
THE VALUE OF POLAROGRAPHIC MEASUREMENTS OF TISSUE-OXYGEN PRESSURE IN EVALUATING FUNCTIONAL STATE OF SEAMEN [ZNACHENIE POLIAROGRAFICHESKOGO ISSLEDOVANIIA NAPRIAZHENIIA KISLORODA V TKANIAKH PRI OTSENKE FUNKTSIONAL'NOGO SOSTOIANIIA ORGANIZMA MORIAKOV]
L. A. TIUNOV and N. M. PETUSHKOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), March 1989, p. 47-49. In Russian. refs

The effects of a posttrip rest on the oxygen content and the rate of oxygen consumption in skin tissues of seamen who have returned from an expedition were investigated using polarographic measurements of oxygen pressure (at days 0, 5, 8, 20, 30, and 45 after the trip) in seamen who were exposed to two types of environment during the trip. The first group included seamen who worked at conditions that exposed them to various types of harmful chemicals; the second group had a minimal contact with these chemicals; and the third group constituted controls. It was found that both oxygen pressure and oxygen consumption measured immediately after the trip and 5 days later were significantly lower in subjects of the first group than in the second-group subjects. These differences decreased with posttrip time, and disappeared after the 30th day. I.S.

A89-43322
THE AVIATION MEDICAL EXAMINER OF THE 1990S AND BEYOND
STANLEY R. MOHLER (Wright State University, Dayton, OH) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 3-9. refs

Pilot risk factors, both fixed and controllable, which are recommended by the American Medical Association for consideration during the initial screening of pilot applicants and upon periodic examinations of pilots are discussed. Particular attention is given to the individually controllable risk factors, such as obesity; the use of nicotine, drugs, and alcohol; the level of serum lipids that can be controlled by diet; diabetes; nutritional habits; exercise practices; sleep practices; living environments; safety practices; social factors; and self-induced stress syndrome. It is emphasized that a major key to surfacing a covert risk factor is an adequate periodic medical history and physical examination. I.S.

A89-43324
FIT TO FLY? SOME COMMON PROBLEMS IN OTOLARYNGOLOGY
P. F. KING (London Independent Hospital, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 19-29.

Some abnormalities discovered in the process of otolaryn-

gological examination of entrants to piloting programs and in established pilots that can affect the fitness to fly are discussed. Attention is given to the diagnosing nasal conditions, such as nasal chronic infection, polyposis, nasal allergy, defected nasal septum, epistaxis, and repaired cleft palate; aural conditions including otitis externa, secretory otitis media, otitis media, perforated drumhead, otosclerosis, sensorineural deafness, vertigo, and acoustic neuroma. The relationship between these conditions and the degree of fitness of the individual in either of these groups are considered, together with measures that can be taken to alleviate these conditions. I.S.

A89-43325
MEDICAL SUPPORT FOR MANNED SPACEFLIGHT
R. M. HARDING (Royal Air Force Institute of Aviation Medicine, Farnborough, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 43-55.

Some aspects of medical care provided at all stages of space missions are described, and the problems of medical care associated with the long-duration missions planned for the future are discussed. The procedures used for the screening and selection of American and Russion space crews, the health-stabilization programs in use, the in-flight medical monitoring and the medical equipment on board the spacecraft, and the medical training received by spacecraft crew are examined. Special consideration is given to the post-flight medical care and the quarantine program for space crews involved in visiting extraterrestrial planets. It is emphasized that a detailed series of medical examinations performed throughout the careers of astronauts and cosmonauts provides an ideal data base for longitudinal health studies. A list of some of the potential clinical hazards of a spaceflight is presented. I.S.

A89-43640
MAN IN SPACE - A SURVEY OF THE MEDICAL LITERATURE
ISABELLE DURAND-ZALESKI Space Power (ISSN 0951-5089), vol. 7, no. 3-4, 1988, p. 353-364. refs

The principal effects and modes of action of the space environment on human physiology are discussed with emphasis on the effects of microgravity on the musculoskeletal and cardiovascular system. Our relative level of knowledge about and ability to compensate for the various effects is highlighted. Author

N89-24024*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Space Biology and Medicine.
A STRATEGY FOR SPACE BIOLOGY AND MEDICAL SCIENCE FOR THE 1980S AND 1990S
1987 214 p
(Contract NASW-3482)
(NASA-CR-184895; NAS 1.26:184895) Avail: NTIS HC A10/MF A01 CSCL 06C

A guideline is provided for developing NASA's long-term mission plans and a rational, coherent research program. Ten topical areas for research are addressed: developmental biology, gravitropism in plants, sensorimotor integration, bone and mineral metabolism, cardiovascular/pulmonary function, muscle remodeling, nutrition, human reproduction, space anemia, and human behavior. Scientific goals, objectives, and required measurements and facilities for each of the major areas of space biology and medicine are identified and described along with primary goals and objectives for each of these disciplines. Proposals are made concerning the use of scientific panels to oversee the implementation of the strategy, life sciences' need for continuous access to spaceflight opportunities, the advantages of a focused mission strategy, certain design features that will enhance spaceflight experimentation, and general facilities. Other topics that are considered include mission planning, crew selection and training, and interagency and international cooperation. A.D.

N89-24025# Navy Experimental Diving Unit, Panama City, FL.
OXYGEN CONSUMPTION RATE OF OPERATIONAL UNDERWATER SWIMMERS Final Report
M. E. KNAFELC Jan. 1989 13 p
(AD-A205331; NEDU-1-89) Avail: NTIS HC A03/MF A01 CSCL 06/4

Prior to evaluating an underwater breathing apparatus (UBA), diver performance must be determined. Previous studies determining the oxygen consumption of swimming and resting divers were done in the laboratory and were limited in scope. Criticisms of those studies suggested that they may not have accurately simulated the underwater work expected of an operational diver. This study measured the oxygen consumption (VO2) sustained by experienced Special Warfare (SPECWAR) operators participating in training exercises. By using a closed-circuit oxygen underwater breathing apparatus, the decrease in the oxygen bottle pressure reflected the amount of oxygen consumed by the diver. These values are comparable to the results of the previous studies. Guidelines reflecting underwater oxygen consumption and estimating carbon dioxide production for calculating carbon dioxide canister duration should be based on the results of these studies. GRA

N89-24026# Armed Forces Radiobiology Research Inst., Bethesda, MD.
A LOW-ENERGY X-RAY IRRADIATOR FOR ELECTROPHYSIOLOGICAL STUDIES
D. A. SCHAUER, G. H. ZEMAN, and T. C. PELLMAR Dec. 1988 35 p
(AD-A205388; AFRRI-TR88-2) Avail: NTIS HC A03/MF A01 CSCL 06/7

A 50 kVp molybdenum target/filter X-ray was installed inside a lead-shielded Faraday cage. High-dose rates of up to 1.54 Gy/min (17.4 keV weighted average photons) were used to conduct local in vitro irradiations of the hippocampal region of guinea pig brains. Electrophysiological recordings of subtle changes in neuronal activity indicate the system is suitable for this application. GRA

N89-24027# Naval Health Research Center, San Diego, CA. Behavior Psychopharmacology Dept.
THE RELATIONSHIP BETWEEN SUBJECTIVE AND OBJECTIVE MEASURES OF SLEEPINESS Interim Report
LAVERNE C. JOHNSON, CHARLES R. FREEMAN, CHERYL L. SPINWEBER, and STEVEN A. GOMEZ 7 Dec. 1988 17 p
(AD-A205861; NHRC-88-50) Avail: NTIS HC A03/MF A01 CSCL 06/4

The purpose of the present study was to examine the relationship among the Multiple Sleep Latency Test (MSLT), lapses during a tapping task, a visual analog scale (VAS) and the Stanford sleepiness scale (SSS). Subjects were 80 male adult nonsmokers (age 20.3 + or - 2.7 years). The MSLT, SSS, and the VAS were obtained at two-hour intervals beginning at 0700 h. On the MSLT, sleep latency was measured from lights out to first spindle, K-complex or rapid-eye-movement (REM) period. The tapping task (lapses) was administered each day at 0600 h, but became nonsignificant as the day progressed. Correlations of objective and subjective measures from scores summed over both days were not significant. The two objective measures were significantly correlated throughout the day and over days as were the subjective measures. This study reaffirms the importance of time of day in sleepiness, and suggests that subjective and objective measures cannot be used interchangeably and may measure different aspects of sleepiness. GRA

N89-24028# Tennessee Univ., Memphis. Dept. of Physiology and Biophysics.
MURAMYL PEPTIDE-ENHANCED SLEEP: PHARMACOLOGICAL OPTIMIZATION OF PERFORMANCE Annual Report, 1 Jun. 1987 - 31 May 1988
JAMES M. KRUEGER 1 Jun. 1988 138 p
(Contract DAMD17-86-C-6194; DA PROJ. 3M1-61102-BS-10)
(AD-A205974) Avail: NTIS HC A07/MF A01 CSCL 06/15

The broad objective of this research is to develop the

information needed to ascertain whether muramyl peptides (MPs) and/or other endogenous sleep factors (SFs) may be useful as somnogenic agents. Several SFs have been identified that may be involved in the cascade of biomedical events involved in regulation of sleep, e.g., interleukin-1 (IL1). Thus, we think it possible that new more effective somnogenic agents could be developed using MPs and/or other putative SFs. In the second year of this contract six experiments were performed: MP somnogenic activity relationships were determined. The preoptic area (POA) of the brain has been implicated in sleep regulation. Relationships between sleep and infectious disease are examined. Staphylococcus aureus greatly altered rabbit sleep patterns over the course of the infections. Endotoxin and its lipid A moiety are components of gram-negative bacteria that share with MPs the ability to induce increased IL1 production. Alpha-melanocyte-stimulating hormone (aMSH), proopiomelanocortin-derived peptide which acts as a physiological inhibitor of some of IL1 actions, inhibited normal sleep and also antagonized IL1-enhanced sleep. GRA

N89-24029# Army Research Inst. of Environmental Medicine, Natick, MA.

PATTERNS OF HUMAN DRINKING: EFFECTS OF EXERCISE, WATER TEMPERATURE AND FOOD CONSUMPTION Final Report, Feb. 1988 - Feb. 1989

PATRICIA C. SZLYK, INGRID V. SILS, RALPH P. FRANCESCONI, and ROGER W. HUBBARD 24 Jan. 1989 24 p

(AD-A206031; USARIEM-M23-89) Avail: NTIS HC A03/MF A01 CSCL 06/4

The effects of exercise, water temperature and food consumption on patterns of ad libitum drinking were studied in 33 men during 6 consecutive cycles of 30 min walking (4.8 km.h-1, 5 percent grade) and 30 min rest in a climatic chamber (40 C, 40 percent relative humidity). On two nonconsecutive days, subjects consumed 15 C (cool) water during one trial and 40 C (warm) water during the other. We previously reported that two groups of drinkers can be identified during work in the heat by the criterion of Body Weight (BW) loss during the trial. Thus, avid drinkers (D) drank sufficiently such that they lost less than 2 percent of their initial Bw when consuming cool water ad libitum, while Reluctant Drinkers (RD) lost more than 2 percent of their BW. When warm water was provided, fluid consumption was reduced by 29 percent and 54 percent in D and RD, respectively and BW deficits were comparably increased. Intake of cool water elicited cyclic drinking patterns with higher rates during walking than during rest periods in both D and RD, whereas consumption of warm water produced this cyclic pattern only after food ingestion during the third rest. Food consumption stimulated fluid intake and reduced BW losses in both trials. Compared to pre-prandial (hours 1-2.5) rates, average post-lunch drinking rates during the last 3h increased 14 percent in D and 19 percent in RD when consuming cool water, and by 46 percent and 74 percent, respectively with warm water. GRA

N89-24030# Army Research Inst. of Environmental Medicine, Natick, MA.

HUMAN TEMPERATURE REGULATION DURING EXERCISE AFTER ORAL PYRIDOSTIGMINE ADMINISTRATION

MARGARET A. KOLKA and LOU A. STEPHENSON Mar. 1989 19 p

(AD-A206032; USARIEM-M27-89) Avail: NTIS HC A03/MF A01 CSCL 06/15

Four healthy males exercised in two experiments at ambient temperatures of 22 C, 29 C and 36 C. The relative humidity was 30 percent in each environment. One experiment in each environment was done 150 minutes after oral (30 mg) pyridostigmine bromide (PYR) administration, and the second experiment was done on a separate day with no medication (CON). Red blood cell cholinesterase was -39 (+ or - 7) percent lower after PYR. Esophageal (Tes) and mean skin temperature (Tsk), forearm blood flow (FBF), forearm sweating, and skin blood flow (SkBF) were measured twice each minute during a 15-min rest period and during 30 minutes of seated cycle exercise at approx. 58 percent VO2 peak. Whole body sweating was determined from weight changes before and after exercise. PYR decreased heart rate at rest and during exercise at 29 C and 36 C. Resting SkBF was 40 percent lower at 29 C and 30 percent lower at 36 C after PYR. During exercise, SkBF was 40 percent lower at 29 C and 50 percent lower at 36 C after PYR compared to CON. There was no effect of PYR on heat production at rest or during exercise. Tsk was different in the three conditions by design, but was unchanged by PYR. Tes was not different at rest in any conditions, but was elevated during exercise at 36 C in PYR compared to CON. GRA

N89-24031# Colorado Univ., Denver. Cardiovascular Pulmonary Research Lab.

HUMAN ADAPTATION TO THE TIBETAN PLATEAU Midterm Report, 7 Aug. 1987 - 16 Feb. 1989

LORNA G. MOORE 15 Feb. 1989 10 p

(Contract DAMD17-87-C-7202; DA PROJ. 3E1-62787-A-879)

(AD-A206463) Avail: NTIS HC A02/MF A01 CSCL 06/10

Humans live at high altitude for longer periods of time on the Tibetan Plateau than elsewhere in the world, thus providing opportunity to investigate the physiologic effects of longer (years to generations) duration of high altitude exposure. This has military importance because persons are stationed at high altitude locations for extended periods and some of the symptoms of failure to adjust to high altitude require months or years for development. We have completed two field projects (Fall 1987 and 1988) which suggest that Tibetans (natives) possess superior O2 transport and/or utilization systems compared to acclimatized newcomers (Han Chinese). Studies conducted in the period covered by this report addressed the control of breathing and blood oxygenation during sleep. In 22 healthy young men (11 Tibetans, 11 Hans), measurements of the control of breathing and lung volume during wakefulness were examined together with nightime studies of breathing and brain blood flow during sleep. Similar, additional studies were carried out in 8, principally Han patients with chronic mountain sickness and 8 age-matched, healthy controls. The data analysis from these studies is not yet complete but suggests that the Tibetans' greater lung volume, ventilatory sensitivity to hypoxia and high frequency respiratory pattern may confer protection against sleep-disordered breathing and thus better pressure blood oxygenation during sleep. GRA

N89-24032# Krug International, San Antonio, TX. Technology Services Div.

ADDITIVITY OF RETINAL DAMAGE FOR MULTIPLE-PULSE LASER EXPOSURES Final Report, Oct. 1985 - Jan. 1988

JOSEPH A. ZUCLICH and MICHAEL F. BLANKENSTEIN Dec. 1988 25 p

(Contract F33615-84-C-0600)

(AD-A206514; USAFSAM-TR-88-24) Avail: NTIS HC A03/MF A01 CSCL 06/10

This study has examined the cumulative effects of multiple-pulse laser exposures in contributing to retinal damage via a thermal mechanism. Three sets of experiments have been conducted to determine the variation of multiple-pulse thresholds: with the interval between pulses; with the number of pulses in the pulse train when the interpulse interval is held constant; and with the retinal image size when both number of pulses and interpulse interval are invariant. In addition, thermal model calculations were carried out to compare model predictions with the experimental data. Conclusions from the experimental data are: (1) The threshold for a multiple-pulse train is related to that for an individual pulse in the train by a function of the number of pulses, but is independent of pulse-repetition frequency and pulse train length. This observation is in general accordance both with the thermal model predictions and with previously empirical models. (2) The additivity of multiple pulses is quantitatively similar for collimated and expanded laser beams incident at the eye. (3) The repair or recovery of laser-induced reversible retinal damage (i.e., sub-threshold with respect to the ophthalmoscopic lesion endpoint) is slow, having a time constant of the order of days. GRA

N89-24369# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. for Aerospace Medicine.
MEDICAL AND RADIATION PROTECTION PROBLEMS IN SPACE
K. E. KLEIN and H. BUECKER *In* ESA, International Symposium on Europe in Space: The Manned Space System p 291-302 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Possibilities of inflight disturbances to space missions due to diseases, operation, and environment are discussed. Equipment needed for diagnosis and treatment is considered. Countermeasures are considered. Research required on the radiation hazard to space crews is suggested, including the measurement of radiation in space, the determination of its biological significance, and the establishment of radiation protection standards and of a system of dosimetric surveillance. ESA

N89-24785# Army Research Inst. of Environmental Medicine, Natick, MA.
SOLUTE MODEL OR CELLULAR ENERGY MODEL: PRACTICAL AND THEORETICAL ASPECTS OF THIRST DURING EXERCISE
ROGER W. HUBBARD, PATRICK C. SZLYK, and LAWRENCE E. ARMSTRONG 16 Feb. 1989 32 p
(AD-A206143; USARIEM-M22/89) Avail: NTIS HC A03/MF A01 CSCL 06/10

Most physiologists would agree that repaying the water debt incurred through evaporative cooling is part of the physiological cost of work in the heat. Pitts and coworkers emphasized that, during work in the heat, men never voluntarily drink as much water as they lose and usually replace only two-thirds of the net water loss. Rothstein et al. observed that this occurred even when water was available, and called this phenomenon voluntary dehydration. Some physiologists feel that voluntary dehydration occurs because thirst is an inadequate stimulus to drinking. On the other hand, Vokes contends one of the best examples of a perfectly functioning homeostatic system is water balance. One of our goals is to reconcile the fact that under certain conditions, both of these statements are correct. We will also try to switch the readers interest from water to salt for, although man may drink, water cannot be held until the missing osmoles are made good. This may be seen as at least one explanation of why thirst is inadequate and there are others. GRA

N89-24786# State Univ. of New York, Plattsburgh. Auditory Research Lab.
THE EFFECTS OF BLAST TRAUMA (IMPULSE NOISE) ON HEARING: A PARAMETRIC STUDY Annual Report, 1 Apr. 1986 - 31 Mar. 1987
ROGER P. HAMERNIK, WILLIAM A. AHROON, ROBERT I. DAVIS, and GEORGE A. TURRENTINE 22 Jul. 1988 332 p
(Contract DAMD17-86-C-6172; DA PROJ. 3M1-61102-BS-15)
(AD-A206180; ARL-88-2) Avail: NTIS HC A15/MF A01 CSCL 06/10

There are three broad goals to this project. The first and primary goal is to begin the systematic development of a data base from which one could estimate the hazards to hearing resulting from exposure to blast waves or other high level impulse noise transients. To achieve this primary objective the following two objectives must first be achieved: (1) to develop a methodology to efficiently acquire data on a large number of experimental animals that have been exposed to a variety of blast wave configurations. This includes audiometric, histological and acoustic variables; (2) to develop a set of blast wave simulation devices which can reliably generate blast waves with a variable distribution of spectral energy in a laboratory environment. This report will describe progress that was achieved on each of these objectives. Data acquisition was completed on 40 chinchillas that were exposed to one of a series of very low frequency (125 Hz) energy-content blast wave exposure paradigms. This data represents the completion of the first of four phases of a parametric study that was designed to estimate the contributions of individual blast wave exposure variables on the production hearing loss. Hearing function was measured using the auditory evoked potential (AEP) technique. The evaluation of hearing consisted of pre- and postexposure measurements of pure tone thresholds and tuning curves (masked thresholds). GRA

N89-24787# School of Aerospace Medicine, Brooks AFB, TX.
CEREBRAL LATERALITY AND HANDEDNESS IN AVIATION: PERFORMANCE AND SELECTION IMPLICATIONS Final Report, Jul. 1987 - Jun. 1988
JOHN S. CROWLEY Jan. 1989 101 p
(AD-A206196; USAFSAM-TP-88-11) Avail: NTIS HC A06/MF A01 CSCL 05/8

This paper reviews the general psychology literature related to handedness and cerebral laterality, beginning with a brief discussion of the research methods employed. Aspects of laterality, including vision, audition, tactile perception, spatial ability, and language are reviewed, as well as theories of cerebral dominance patterns. The handedness literature is examined, with attention to measurement, theories of genesis, sociocultural factors, and sex differences. There are many postulated correlates of human laterality, including performance, occupation, emotions, and various diseases. References, suggest that pilots who have no strong hand preference may be at a slight disadvantage in the cockpit, whereas those who are consistently right-side dominant tend to do well. Current neuropsychological theory would suggest that the ideal aviator brain should be well lateralized, to minimize competition for hemispheric resources. There is evidence that pilots who are poorly lateralized may exhibit traits of right-left confusion. Several aircraft accidents have been attributed to pilots failing to correctly distinguish between left and right. Performance in flight school seems to be associated with right hemispheric (visuospatial) ability, as measured by tests of cognitive function. These tests have utility in the selection of aircrew; techniques for enhancing cognitive laterality may also prove useful. GRA

N89-24788# Georgia State Univ., Atlanta.
NEUROCHEMICAL CONTROL OF CIRCADIAN RHYTHMS Annual Report, 1 Apr. 1988 - 31 Mar. 1989
ALBERS H. ELLIOTT 20 Mar. 1989 9 p
(Contract N00014-87-K-0172; RR04108)
(AD-A206213) Avail: NTIS HC A02/MF A01 CSCL 06/1

We have continued our investigation of the neurochemical systems contained in the circadian clock localized within the suprachiasmatic nucleus (SCN). Our primary focus has been to determine the circadian functions of a subpopulation of SCN interneurons in which vasoactive intestinal peptide (VIP), peptide histidine isoleucine (PHI) and gastrin releasing peptide (GRP) have been co-localized. In these studies we have demonstrated: (1) VIP/PHI neurons are found in the ventrolateral SCN where photic projections terminate, (2) a rhythm of VIP/PHI mRNA within the SCN that correlates with day-night cycle, (3) a modulation of SCN content of VIP and PHI by environmental lighting, (4) combined microinjection of VIP/PHI/GRP into the SCN mimics the phase delay of circadian rhythms produced by light, and (5) VIP/PHI/GRP alters the electrical activity of SCN single units. In other studies we have investigated the possible circadian functions of arginine vasopressin, GABA and neuropeptide Y (NPY) within the SCN, and the role of NPY within the para-ventricular nucleus on corticosterone secretion. GRA

N89-24789# Army Research Inst. of Environmental Medicine, Natick, MA.
IS SALT AT FAULT
LAWRENCE E. ARMSTRONG and ROBERT H. LIND 28 Feb. 1989 12 p
(AD-A206518; USARIEM-M26/89) Avail: NTIS HC A03/MF A01 CSCL 06/8

This article reviews the fluid-electrolyte balance which is altered by exercise in hot environments at a variety of durations--focusing on sodium chloride losses. Recommendations are presented to

assist athletes in maintaining electrolyte balance practically. Because of the journal involved, athletic situations and circumstances are highlighted. GRA

N89-24790*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
A METHOD OF ISOLATING TREADMILL SHOCK AND VIBRATION ON SPACECRAFT
WILLIAM E. THORNTON Apr. 1989 18 p
(NASA-TM-100474; S-591; NAS 1.15:100474) Avail: NTIS HC A03/MF A01 CSCL 06/19

A major problem is currently felt to exist in the implementation of materials processing on a spacecraft. Crystal growers place requirements of one micro-g or less on the vehicle. Simple math produces startling figures for such a restriction e.g., for each ton of vehicle mass with 10(-6) g acceleration limit; Perturbing Force limit, F = .002 lb. For each 10(5) lbs F = 0.1 lb. For each 10(6) lbs F = 1.0 lb. Forces generated by normal human movement on spacecraft of 5x10(5) pounds weight are on an order-of-magnitude greater than allowed by this specification and forces generated by locomotion on a treadmill are more than two orders-of-magnitude greater. Other exercises and normal onboard functions generate forces in between. To accommodate many essential functions it is obvious that even on a vehicle as large as Space Station, a reduction of more than two orders of magnitude in force is required. Commonly used passive shock and vibration isolation devices are complex, heavy, and also would have difficulty meeting the requirements. However, by a new arrangement, adequate isolation can be obtained. Isolation of the treadmill will be treated since it is considered the most significant disturbance at this time. Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A89-42160
TRIAZOLAM IMPAIRS LEARNING AND FAILS TO IMPROVE SLEEP IN A LONG-RANGE AERIAL DEPLOYMENT
DAVID M. PENETAR, GREGORY BELENKY, JAMES J. GARRIGAN, and DANIEL P. REDMOND (U.S. Army, Walter Reed Army Institute of Research, Washington, DC; U.S. Army, Medical Research Unit, Fort Bragg, NC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 594-598. refs

The effect of triazolam as a sleep-inducing drug was investigated in U.S. soldiers deployed on a field exercise in the Middle East, who received either placebo or 0.5 mg of triazolam once they were airborne on their journey. Sleep and activity were measured during the flight by means of a wrist-worn activity monitor, while the mood, cognitive performance, and sleepiness were assessed during a refueling stop 8 h after the drug administration. It was found that triazolam did not increase the duration or improve the continuity of sleep during the 8-h flight, nor did it affect the mood or sleepiness. On the other hand, the ability to recall verbal material presented prior to testing was impaired 8 h after ingestion. I.S.

A89-42162
AIRCRAFT COORDINATION TRAINING IN THE U.S. AIR FORCE AIR TRAINING COMMAND
JOHN A. SHAUD (USAF, Air Training Command, Randolph AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 601, 602.

Coordinated action among the various members of a multi-crew aircraft is essential for safe flight. Aircrew coordination problems typically fall into one of three broad categories: (1) improper task prioritization, (2) ineffective communication, or (3) lack of coordinated action. The airlines and the Military Airlift Command have very successful crew coordination training programs. The Air Training Command (ATC) wil soon transition to a specialized pilot training program where pilots destined for large multi-place aircraft will be trained differently from those who will fly fighter aircraft. Under this new training program, ATC will help establish a crew mind-set early in the new multi-place pilot's career by providing initial crew coordination training. Author

A89-42163
INTERPERSONAL AND GROUP-BEHAVIOR SKILLS TRAINING FOR CREWS ON SPACE STATION
JOHN M. NICHOLAS (Loyola University, Chicago, IL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 603-608. Research supported by Loyola University. refs

With the advent of Space Station, planners must come to terms with the inevitable psychosocial crew problems that accompany long-term confinement. Although some problems may be resolvable with the assistance of an on-board professional therapist-consultant, others can only be settled by whole-crew training in interpersonal, emotional-support, and group-interaction skills. This article describes problem situations, kinds of skills training needed to resolve them, and the resistance that proposals for behavioral training might encounter. Author

A89-43323
CABIN STAFF'S PERCEPTION OF THE IMPACT OF FLYING ON THEIR PHYSICAL HEALTH
CLAIRE MARRISON and HELEN MUIR (Cranfield Institute of Technology, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 2, no. 1, 1988, p. 11-17. refs

The impact of individual, operational, and workload variables on physical health of the cabin staff of commercial airlines was assessed in 453 subjects using a self-completion questionnaire, based on the questionnaire designed by Kobrick and Sampson (1979), which was completed after flight. Biographical data, roster information, and data on pre-flight and post-flight measures of stress and fatigue were also collected. Results demonstrated the existence of multifaceted effects on physical health and the complexity of the interactions which exist between health, stress, and fatigue. The major 'occupational hazard' for cabin staff was found to be physical discomfort. The severity of the symptoms experienced were influenced by the employment status, age, and length of employment. Operational and workload variables were also found to play a role in the determination of the level of physical discomfort. I.S.

N89-24033*# McDonnell-Douglas Corp., Long Beach, CA.
CREW PROCEDURES AND WORKLOAD OF RETROFIT CONCEPTS FOR MICROWAVE LANDING SYSTEM
LELAND G. SUMMERS and JON E. JONSSON May 1989 48 p
(Contract NAS1-18028)
(NASA-CR-181700; NAS 1.26:181700; MDC-K1413) Avail: NTIS HC A03/MF A01 CSCL 05/9

Crew procedures and workload for Microwave Landing Systems (MLS) that could be retrofitted into existing transport aircraft were evaluated. Two MLS receiver concepts were developed. One is capable of capturing a runway centerline and the other is capable of capturing a segmented approach path. Crew procedures were identified and crew task analyses were performed using each concept. Crew workload comparisons were made between the MLS concepts and an ILS baseline using a task-timeline workload model. Workload indexes were obtained for each scenario. The results showed that workload was comparable to the ILS baseline for the MLS centerline capture concept, but significantly higher for the segmented path capture concept. Author

N89-24034# Naval Submarine Medical Research Lab., Groton, CT.
PSYCHOMETRIC FUNCTION RECONSTRUCTION FROM ADAPTIVE TRACKING PROCEDURES Interim Report

MARJORIE R. LEEK, THOMAS E. HANNA, and LYNNE MARSHALL 29 Nov. 1988 26 p
(AD-A205668; NSMRL-1095) Avail: NTIS HC A03/MF A01
CSCL 05/8

Adaptive psychophysical procedures have come into widespread use for the estimation of psychophysical performance. Their popularity arises from their speed of implementation and efficiency in the stimulus levels far removed from the selected target values are seldom presented. Thus, experimental time and subject energy can be devoted to a precise delineation of performance at and around the target or threshold region. However, sometimes it is valuable to be able to describe a subject's performance across a wide range of stimulus values by construction of a psychometric function showing how performance changes with changing stimulus values. Since adaptive tracking procedures are specifically assigned to avoid stimulus levels far from the target value, the psychometric function constructed from the data in the track may be precisely defined near the target where there are many trial presentations for each level, but be a poor reflection of performance at levels removed from the target. While some authors have attempted to analyze the trial-by-trial data produced by an adaptive track to construct a psychometric function, there is little evidence that the functions they report do, in fact, represent the underlying function governing subject performance. GRA

N89-24035# Navy Personnel Research and Development Center, San Diego, CA.
DEVELOPMENT AND EVALUATION OF INTEGRATING DETAILS: A COMPLEX SPATIAL PROBLEM SOLVING TEST Technical Report, Jan. 1986 - Jun. 1988
DAVID L. ALDERTON Feb. 1989 58 p
(AD-A205860; NPRDC-TR-89-6) Avail: NTIS HC A04/MF A01
CSCL 05/9

This report summarizes the theory behind and the development, evaluation, and refinement of a complex spatial processing test, Integrating Details. In the course of revamping and making the Armed Services Vocational Aptitude Battery (ASVAB) adaptive, the opportunity exists for replacing or adding test to the battery. Tests of spatial ability, a major dimension of human intelligence, are not represented in the ASVAB so they are reasonable candidates for inclusion. The vast psychometric literature on spatial ability suggests that only complex spatial tests are likely to be valid for both school and job performance. Theoretical and empirical work from visual cognition and mental imagery provided further guidelines for the development of a complex spatial test. Methodological techniques from componential analysis were used to initiate the test and develop an information processing model for test item solution. The results suggest that Integrating Details is a complex spatial problem solving test, that is relatively independent of verbal ability, that the test is reliable and has substantial construct validity. Furthermore, analyses demonstrate that the ability measured by Integrating Details is substantially unique from those measured by the ASVAB and thus there is ample opportunity for the test to augment the predictive validity of the ASVAB. A final 40-item version of the test is recommended for advanced development and validation with military enlisted personnel. GRA

N89-24036# South Dakota Univ., Vermillion. Human Factors Lab.
QUASI-MONOCHROMATIC VISUAL ENVIRONMENTS AND THE RESTING POINT OF ACCOMMODATION
EDWARD TRAUTMAN, VERNON ELLINGSTAD, MICHAEL LILIENTHAL (Naval Training Systems Center, Orlando, FL.), and MARY A. TRAUTMAN 1988 81 p Sponsored by Navy
(AD-A205938; NTSC-TR-88-028) Avail: NTIS HC A05/MF A01
CSCL 06/4

This investigation explored the importance of color as a factor in deterioration of correct visual accommodation and involuntary regression to the resting point of accommodation. The involvement of voluntary control of accommodation processes was manipulated by requiring extended performance on a difficult visual task. Broad band red and green as well as white visual environments were presented in two related experiments. The first considered color, light level and time on task. The second attempted a more specific examination of color and time on task. Expected light level, time on task and chromatic aberration effects were evident. Declining light levels and extended time on task produced expected decrements in accommodation. Ambient color environments produced predictable differential accommodation. No statistically significant differences were revealed to support the possibility of color mediated differential regression to resting point of accommodation. GRA

N89-24037# Duke Univ., Durham, NC. Center for Decision Studies.
MONITORING INFORMATION PROCESSING AND DECISIONS: THE MOUSELAB SYSTEM
ERIC J. JOHNSON, JOHN W. PAYNE, JAMES R. BETTMAN, and DAVID A. SCHKADE Feb. 1989 56 p
(Contract N00014-80-C-0114; RR04209)
(AD-A205963; ONR-TR-89-4) Avail: NTIS HC A04/MF A01
CSCL 12/5

In order to better understand the cognitive processes underlying judgment and choice, decision researchers have begun to use a variety of process tracing techniques. The idea is to complement many traditional measures of judgment and choice with a high density of observations on the intermediate stages of processing. This report documents a procedure for monitoring the information acquisition stages of decision behavior. The procedure is based on a micro-computer controlled pointing device called a mouse. The procedure offers a number of flexible graphics and data recording routines. The relationship of the procedure to other process tracing techniques is discussed. GRA

N89-24038# City of Hope Medical Center, Duarte, CA.
LONG TERM SYNAPTIC PLASTICITY AND LEARNING IN NEURONAL NETWORKS Final Technical Report, 15 Aug. 1986 - 14 Nov. 1988
THOMAS H. BROWN 14 Jan. 1989 13 p
(Contract F49620-86-C-0099)
(AD-A205993; AFOSR-89-0361TR) Avail: NTIS HC A03/MF A01
CSCL 06/1

The purpose of this project was to understand rapidly induced and persistent forms of synaptic memory. The properties of the synaptic modifications underlying this plasticity could account for some of the adaptive and self organizing capabilities of simple and well-defined neurobiological networks in the mammalian brain. These can be studied rigorously using neurophysiological and optical techniques. Sprearheading the project effort was the working hypothesis that long-term synaptic potentiation (LTP), a use-dependent enhancement of synaptic transmission, may mediate certain mnemonic functions of hippocampal circuitry and other forebrain structures. The project was organized around four categories of interrelated specific aims. First, new quantal analysis methods were developed and tested (Aim 2) using patch-clamp techniques to study charge fluctuations of synaptic transmission during LTP at the crayfish neuromuscular junction. Accomplishment of this aim was necessary in order to be able to transfer and apply the new method to analyze and learn the biophysical mechanisms underlying LTP in hippocampal synapses (Aim 1) a much more difficult preparation to study at this level. GRA

N89-24039# Army Research Inst. of Environmental Medicine, Natick, MA.
TREATMENT WITH TYROSINE, A NEUROTRANSMITTER PRECURSOR, REDUCES ENVIRONMENTAL STRESS IN HUMANS
LOUIS E. BANDERET and HARRIS R. LIEBERMAN 1988 17 p
(AD-A206035; USARIEM-M17-89) Avail: NTIS HC A03/MF A01
CSCL 06/15

Acutely stressful situations can disrupt behavior and deplete brain norepinephrine and dopamine, catecholaminergic neurotransmitters. In animals, administration of tyrosine, a food constituent and precursor of the catecholamines, reduces these

behavioral and neurochemical deficits. Using a double-blind, placebo-controlled crossover design we investigated whether tyrosine (100 mg/kg) would protect humans from some of the adverse consequences of a 4.5 hour exposure to cold and hypoxia. Tyrosine significantly decreased symptoms, adverse moods, and performance impairments in subjects who exhibited average or greater responses to these environmental conditions. These results suggest that treatment with tyrosine should be evaluated in a variety of acutely stressful situations for beneficial behavioral effects. GRA

N89-24040# Washington Univ., Saint Louis, MO. Dept. of Neurology.
THE ATTENTION SYSTEM OF THE HUMAN BRAIN
MICHAEL I. POSNER and STEVEN E. PETERSEN 28 Feb. 1989 31 p
(Contract N00014-86-K-0289)
(AD-A206157; TR-89-1) Avail: NTIS HC A03/MF A01 CSCL 05/8

The concept of attention as central to human performance extends back to the start of experimental psychology, yet even a few years ago, it would not have been possible to outline in even a preliminary form a functional anatomy of the human attentional system. New developments in neuroscience have opened the study of higher cognition to physiological analysis, and have revealed a system of anatomical areas that appear to be basic to the selection of information for focal (conscious) processing. The importance of attention is its unique role in connecting the mental level of description of processes used in cognitive science with the anatomical level common in neuroscience. Sperry describes the central role that mental concepts play in understanding brain function. As is the case for sensory and motor systems of the brain, our knowledge of the anatomy of attention is incomplete. Nevertheless, we can now begin to identify some principles of organization that allow attention to function as a unified system for the control of mental processing. Although many of our points are still speculative and controversial, we believe they constitute a basis for more detailed studies of attention from a cognitive-neuroscience viewpoint. Perhaps even more important for furthering future studies, multiple methods of mental chronometry, brain lesions, electrophysiology, and several types of neuro-imaging have converged on common findings. GRA

N89-24041# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
THE ROLE OF KNOWLEDGE IN VISUAL SHAPE REPRESENTATION Ph.D. Thesis
ERIC SAUND Oct. 1988 303 p
(Contract N00014-85-K-0124)
(AD-A206173; AI-TR-1092) Avail: NTIS HC A14/MF A01 CSCL 12/9

This thesis shows how knowledge about the visual world can be built into a shape representation in the form of a descriptive vocabulary making explicit the important spatial events and geometrical relationships comprising an object's shape. We offer two specific computational tools establishing a framework by which a shape representation may support a variety of later visual processing tasks: (1) By maintaining shape tokens on a Scale-Space Blackboard, information about configurations of shape events such as contours and regions can be manipulated symbolically, while the pictorial organization inherent to a shape's spatial geometry is preserved. (2) Through the device of dimensionality-reduction, configurations of shape tokens can be interpreted in terms of their membership within deformation classes; this provides leverage in distinguishing shapes on the basis of subtle variations reflecting deformations in their forms. The power in these tools derives from their contributions to capturing knowledge about the visual world. In contrast to building block approaches to shape representation we employ a large and extensible vocabulary of shape descriptions tailored to the constraints and regularities of particular shape worlds. GRA

N89-24042# Washington Univ., Saint Louis, MO. Dept. of Neurology and Neurological Surgery.
RELATING ATTENTION TO VISUAL MECHANISMS
GORDON L. SHULMAN 28 Feb. 1989 20 p
(Contract N00014-86-K-0289; RR04206)
(AD-A206452; ONR-TR-89-2) Avail: NTIS HC A03/MF A01 CSCL 06/4

The effect of attention on visual perception has been a subject of great controversy. Much research on attention over the last thirty years has been framed by the debate on this question between proponents of early and late selection. Late selection theorists have argued that all perceptual encoding, including recognition, and certain semantic analyses are accomplished in parallel, while early selection theorists have countered that only simple physical analyses can be conducted in parallel. More sophisticated analyses of shape that support object recognition and memory access are conducted by limited capacity systems. Although the terms perceptual and semantic include a wide variety of processes, there has been an unfortunate tendency to extrapolate conclusions to the entire collection of processes based on results from a few. For example, researchers have tacitly assumed that if any evidence for semantic processing of unattended material is found, then perceptual operations must be parallel. This inference, however, only applies to the perceptual operations relevant to the recognition of the experimental stimuli, which are generally upright block alphanumeric characters. Recognition of these stimuli does not require the resolution of a vast number of problems the visual system must solve: the analysis of motion, three-dimensional space, constancies of various sorts, etc. GRA

N89-24374# European Space Agency, Paris (France).
THE TRAINING CONCEPT FOR ESA ASTRONAUTS AND THE ASSOCIATED FACILITIES
H. D. HOPKINS *In its* International Symposium on Europe in Space: The Manned Space System p 367-369 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The number of astronauts required for the Hermes program is estimated at 12. Training facilities needed are determined for basic training and specialized and mission training. ESA

N89-24375# Centre National d'Etudes Spatiales, Toulouse (France).
THE HERMES SYSTEM TRAINING CONCEPT [CONCEPT D'ENTRAINEMENT AU SYSTEME HERMES]
G. GARGIR *In* ESA, International Symposium on Europe in Space: The Manned Space System p 371-377 Oct. 1988 In FRENCH; *ENGLISH summary*
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Hermes crew, crew activities, and astronaut training are discussed. Hermes astronauts will be flight crew members, mission engineers, and passengers bound for space stations. The type of training required for each type of astronaut is shown, along with the number of hours at each particular facility e.g., 1800 hr of mission training for the pilot, including 240 hr with the Hermes training airplane. ESA

N89-24396# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, *Cologne (Germany, F.R.).*
CREW TRAINING ASPECTS
F. J. DEMOND, W. MUELLER-BREITKREUTZ, and H. G. NEUHAEUSER *In* ESA, International Symposium on Europe in Space: The Manned Space System p 541-549 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Astronaut training for Hermes and Columbus is discussed. Experience from the German Spacelab missions is reviewed and training facilities needed for Hermes and Columbus are indicated. Two main types of facilities are proposed: an integrated system training facility with full scale mock-ups of the specific space

elements; and single system training facilities, which allow training on single subsystems or payload elements. ESA

N89-24791# Army Research Inst. of Environmental Medicine, Natick, MA.
FIELD-DEPENDENCE AND JUDGMENT OF WEIGHT AND COLOR REVISITED: SOME IMPLICATIONS FOR THE STUDY OF SENSORY DISCRIMINATION
BERNARD J. FINE Jan. 1989 20 p Submitted for publication (Contract DA PROJ. 3M1-61102-BS-15)
(AD-A206141; USARIEM-M20/89) Avail: NTIS HC A02/MF A01 CSCL 05/8

Based on a construct termed sensitivity of the nervous system and the assumption that field-dependence is an indirect approximation of level of sensitivity, our previous research has predicted and found field-independent groups to be superior to field-dependent groups in color and weight discrimination and in contrast sensitivity. Here, we re-examine weight judgment using a more discriminating test and attempt to replicate previous color results. Seventeen females performed a weight discrimination task (15 weights, 75 to 145 grams, in 5-gram increments) on two successive days, three trials/day, and two trials on the Farnsworth-Munsell 100 Hue Test. A field-independent group (N=5) performed significantly better than a field-dependent group (N=6) on all trials of both tasks. Although N is small, this is the fifth replication (in five attempts) of the color discrimination results and a strong validation of the previous results with weights. It is suggested that in studies of sensory discrimination, some of the so-called random error now must be considered as systematic error, or bias, and that attention should be given to level of sensitivity of participants. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A89-40811#
A FORMULATION FOR STUDYING DYNAMICS OF THE SPACE STATION BASED MRMS AND ITS APPLICATION
YASUHIRO MORITA and VINOD J. MODI (British Columbia, University, Vancouver, Canada) Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 37, no. 422, 1989, p. 128-134. In Japanese, with abstract in English. refs

A relatively general formulation for studying dynamics of a flexible Mobile Remote Manipulator System (MRMS), supported by an orbiting flexible platform, is developed using the Lagrangian approach with generalized forces accounting for the environmental effects, damping, and control. The computational algorithm is so structured as to isolate the effects of various system parameters, thus helping in assessment of their relative importance. Application of the general formulation, illustrated through several typical MRMS configurations of practical importance, reveals complex interactions between vibrational and librational degrees of freedom, in the presence of MRMS maneuver, over a range of system parameters and initial conditions. Effectiveness of the formulation is also demonstrated through another illustrative example of the SCOLE configuration representing the Shuttle-based flexible beam supporting a rigid reflector plate at its end. Author

A89-41457
SPACE ROBOTICS - INTRA-VEHICULAR OPERATIONS
BARRY KEEPENCE (Marcol Computer Systems, Ltd., Bristol, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 42, May 1989, p. 239-246. refs

The introduction of robotics in space will have a major impact on payload, spacecraft, and ground station design and operations. An intelligent and advanced robot could perform many tasks as well as or even better than astronauts. The possible applications of robots in Space are manifold but, in the near future, first applications are likely to be intra-vehicular. This paper analyses and considers payload requirements in the context of robotic operations. The specific requirements and constraints of a robot operating in space are examined. The problems of teleoperation, teleprogramming and the implications of integrating robotics into telescience operations are discussed. Author

A89-42153* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE EFFECTS OF WINDOW SHAPE AND RETICLE PRESENCE ON PERFORMANCE IN A VERTICAL ALIGNMENT TASK
ERIKA L. ROSENBERG, RICHARD F. HAINES, and KEVIN JORDAN (NASA, Ames Research Center, Moffett Field; San Jose State University, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 60, June 1989, p. 543-549. refs
(Contract NCC2-327)

This study was conducted to evaluate the effect of selected interior work-station orientational cuing upon the ability to align a target image with local vertical in the frontal plane. Angular error from gravitational vertical in an alignment task was measured for 20 observers viewing through two window shapes (square, round), two initial orientations of a computer-generated space shuttle image, and the presence or absence of a stabilized optical alignment reticle. In terms of overall accuracy, it was found that observer error was significantly smaller for the square window and reticle-present conditions than for the round window and reticle-absent conditions. Response bias data reflected an overall tendency to undershoot and greater variability of response in the round window/no reticle condition. These results suggest that environmental cuing information, such as that provided by square window frames and alignment reticles, may aid in subjective orientation and increase accuracy of response in a Space Station proximity operations alignment task. Author

A89-42728
ERGONOMIC DESIGN FOR PERSPECTIVE FLIGHT-PATH DISPLAYS
CHRISTOPHER D. WICKENS, IAN HASKELL, and KAREN HARTE (Illinois, University, Savoy) (IEEE, International Conference on Systems, Man, and Cybernetics, Beijing and Shenyang, People's Republic of China, Aug. 8-12, 1988) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 9, June 1989, p. 3-8. Research sponsored by the Boeing Commercial Aircraft Co. refs

The design and evaluation for the display of a four-dimensional perspective flight-path predictor (X, Y, Z, and time) are described. Five basic principles of human performance are used to guide the choice of display configuration: working memory limitations, object integrality, compatibility, consistency, and visual momentum. Each principle is discussed along with the corresponding display and experimental design. Twenty-four pilots flew simulated approaches to North American airports, using one of three displays: (1) a display with four-dimensional preview and predictor information, which was configured with inside-out perspective; (2) the same display configured with outside-in perspective; or (3) an inside-out flight director with neither preview nor predictor. The results revealed an advantage for predictor/preview information, which was greatest with the inside-out perspective. The display aids did not appear to be helpful. I.E.

A89-42808
RESOLVED MOTION RATE CONTROL OF SPACE MANIPULATORS WITH GENERALIZED JACOBIAN MATRIX
YOJI UMETANI and KAZUYA YOSHIDA (Tokyo Institute of Technology, Japan) IEEE Transactions on Robotics and Automation (ISSN 1042-296X), vol. 5, June 1989, p. 303-314. refs

The authors establish a control method for space manipulators taking dynamical interaction between the manipulator arm and the base satellite into account. The kinematics of free-flying multibody systems is investigated by introducing the momentum conservation

law into the formulation and a novel Jacobian matrix in generalized form for space robotic arms is derived. The authors develop a control method for space manipulators based on the resolved motion control concept. The proposed method is widely applicable in solving not only free-flying manipulation problems but also attitude-control problems. The validity of the method is demonstrated by computer simulations with a realistic model of a robot satellite. I.E.

A89-43024
SPACE COLORISTICS
VLADIMIR V. VASIUTIN (Akademiia Voenno-Vozdushnykh Sil, Moscow, USSR) and ARTUR A. TISHCHENKO (Nauchno-Proizvodstvennoe Ob'edinenie Priroda, Moscow, USSR) Scientific American (ISSN 0036-8733), vol. 261, July 1989, p. 84-90.

Studies to determine the colors of natural formations and phenomena on the earth as seen from outer space are reviewed. An atlas consisting of samples of 1,000 colors observed from space has been compiled using observations from the Salyut orbital station. Consideration is given to the development of a portable visual colorimeter based on a single-lens-reflex camera and an automatic photoelectric colorimeter for use in space. In addition, studies of the characteristics of human color vision during long space flights are examined. R.B.

A89-43074#
THE HERMES ROBOT ARM [HERMES ROBOT ARM]
D. F. KUIPER (Fokker Space and Systems, Amsterdam, Netherlands) Ruimtevaart, vol. 38, April 1989, p. 20-30. In Dutch.

The design concept, applications, and present status of the Hermes Robot Arm (Hera), a telemanipulator system being developed for use with the ESA space shuttle Hermes, are discussed and illustrated with extensive drawings and diagrams. A general overview of the roles of Hermes and the MTFF in the International Space Station scenario is given, and the use of Hera to handle orbit-replaceable units, manipulate large structural components, or serve as a mobile platform for astronauts during EVAs is described. Particular attention is given to the functions of Hera during Hermes servicing of the MTFF; the Hera arm structure, end-effector, control system, and simulation and test facilities; and the organization of the Hera R&D program. Specific engineering goals for the immediate future are outlined. T.K.

A89-43141
TELEROBOTICS SYSTEM SIMULATION FOR SPACE APPLICATIONS
SHOU X ZHANG (Northwestern Polytechnical University, Xian, People's Republic of China), FAN T. TSENG, and BERNARD J. SCHROER (Alabama, University, Huntsville) IN: 1988 Annual Summer Computer Simulation Conference, 20th, Seattle, WA, July 25-28, 1988, Proceedings. San Diego, CA, Society for Computer Simulation International, 1988, p. 713-718. Research supported by Alabama Research Institute and Alabama Dept. of Economic and Community Affaires. refs

The development of a telerobotics laboratory for studying man's role in space telerobotics is discussed. The laboratory is configured around a Puma 562 6 DOF arm. A high-resolution black and white CCD camera is mounted on the arm. The following basic tasks were identified for space servicing, structure assembling, and contingencies: (1) the operation of mechanical connections, electrical connections, and latching devices, (2) the grasping and positioning of objects, and (3) the operation of cutting and welding devices. K.K.

N89-23904*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ASTRONAUT TOOL DEVELOPMENT: AN ORBITAL REPLACEABLE UNIT-PORTABLE HANDHOLD
JOHN W. REDMON, JR. *In its* The 23rd Aerospace Mechanisms Symposium p 181-193 Mar. 1989
Avail: NTIS HC A15/MF A01 CSCL 05H

A tool to be used during astronaut Extra-Vehicular Activity (EVA) replacement of spent or defective electrical/electronic component boxes is described. The generation of requirements and design philosophies are detailed, as well as specifics relating to mechanical development, interface verifications, testing, and astronaut feedback. Findings are presented in the form of: (1) a design which is universally applicable to spacecraft component replacement, and (2) guidelines that the designer of orbital replacement units might incorporate to enhance spacecraft on-orbit maintainability and EVA mission safety. Author

N89-24043# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics Computer Science.
DIRECT MANIPULATION AND OTHER STYLES OF MAN-MACHINE INTERACTION
J. M. VERSENDAAL 1988 20 p
(PB89-146070; REPT-88-53) Avail: NTIS HC A03/MF A01 CSCL 05/8

As new technologies are used in computer hardware, such as fast refresh graphics screens, and as people began to realize that common computer interaction could be difficult, a new and, to the user often a more comprehensible computer dialogue style has emerged. Using that dialogue style, users interact with the computer system by directly manipulating the object of interest presented on the screen. Schneiderman called this new dialogue style Direct Manipulation (DM). A precise description of DM along with conventional dialogue styles is given. DM interfaces often cause unique problems, compared with other dialogue styles. These problems, their causes and possible ways of solving them are discussed. Author

N89-24044*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SPACE STATION ECLSS SIMPLIFIED INTEGRATED TEST Final Report
RICHARD G. SCHUNK, ROBERT M. BAGDIGIAN, ROBYN L. CARRASQUILLO, KATHYRN Y. OGLE, and PAUL O. WIELAND Mar. 1989 42 p
(NASA-TM-100363; NAS 1.15:100363) Avail: NTIS HC A03/MF A01 CSCL 06/11

A discussion of the Space Station Simplified Integrated Test (SIT) was conducted. The first in a series of three integrated Environmental Control and Life Support (ECLS) system tests, the primary objectives of the SIT were to verify proper operation of ECLS subsystems functioning in an integrated fashion as well as to gather preliminary performance data for the partial ECLS system used in the test. A description of the SIT configuration, a summary of events, a discussion of anomalies that occurred during the test, and detailed results and analysis from individual measurements and water and gas samples taken during the test are included. The preprototype ECLS hardware used in the test is reported providing an overall process description and theory of operation for each hardware item. Author

N89-24045# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.
AN ICAI (INTELLIGENT COMPUTER AIDED INSTRUCTION) ARCHITECTURE FOR TROUBLESHOOTING IN COMPLEX DYNAMIC SYSTEMS
JANET L. FATH, CHRISTINE M. MITCHELL, and T. GOVINDARAJ Dec. 1988 62 p
(Contract N00014-87-K-0482; RM3-3-M-20)
(AD-A205434; GIT-88-4) Avail: NTIS HC A04/MF A01 CSCL 23/2

AHAB is an architecture for simulator-based ICAI (Intelligent Computer Aided Instruction) programs to teach troubleshooting in complex, dynamic environments. The architecture posits three elements of a computerized instructor: The task model, the student model, and the instructional module. The task model is a prescriptive model of expert performance that uses symptomatic and topographic search strategies to provide students with directed problem-solving aids. The student model is a descriptive model of student performance in the context of task model. This student

model compares the student and task models, critiques student performance in the context of the task model. This student model compares the student and task models, critiques student performance, and provide interactive performance feedback. Finally, the instructional module coordinates information presented by the instructional media, the task model, and the student model so that each student receives individualized instruction. Concept and meta-concept knowledge that supports these elements is contained in frames and production rules, respectively. GRA

N89-24046# Defence Research Establishment, Ottawa (Ontario). Protective Sciences Div.
THE CONCEPT AND THEORETICAL CONSIDERATIONS OF A COLD WEATHER CLOTHING SYSTEM
B. CAIN, B. FARNSWORTH, and R. OSCZEVSKI Dec. 1988 41 p
(AD-A205476; DREO-998) Avail: NTIS HC A03/MF A01 CSCL 05/8

The concept and theoretical considerations of a clothing system for cold weather is discussed. The temperature range of interest was -40 to 10 C which was divided into an extreme-cold temperature range (-40 to -10 C) and a cold-wet temperature range (-10 to 10 C). An essential goal of the clothing system was to provide adequate thermal insulation for metabolic rates between 150 and 600 W while a desirable goal was to provide adequate thermal insulation for metabolic rates up to 1000 W. The clothing differs from conventional clothing mainly in its doctrine of use as insulation is added to or removed from the outside. This makes the clothing more versatile and more easily used. GRA

N89-24047# Center for Night Vision and Electro-Optics, Fort Belvoir, VA.
NIGHT VISION GOGGLES (AN/PVS-7) PERFORMANCE ISSUES AND ANSWERS Final Report, 1986 - 1988
WALTER B. MORROW, JR. Mar. 1989 47 p
(AD-A206117; AMSEL-NV-TR-0075) Avail: NTIS HC A03/MF A01 CSCL 17/5

During 1987, pursuant to a tasking by the Undersecretary of the Army through the Institute for Defense Analysis, the U.S. Army CECOM Center for Night Vision and Electro-Optics (C2NVEO) carried out a comprehensive series of studies to characterize the spectral content of night sky irradiance across the spectral sensitivity bands of second and third generation AN/PVS-7 Night Vision Goggles. This effort was then logically extended to the development of a detailed comparative performance analysis of night vision goggles within the true spectral characterization of the night sky environment. Several related issues were also of concern to the Undersecretary, including the effect of various bandpass and notch spectral filters with goggles, and finally the operational life and reliability of night vision goggles. GRA

N89-24048# Analytics, Inc., Willow Grove, PA.
DESIGN OF A MANPRINT TOOL FOR PREDICTING PERSONNEL AND TRAINING CHARACTERISTICS IMPLIED BY SYSTEM DESIGN Final Report, Jun. 1987 - Jan. 1988
ALFRED O. DICK, ALVAH C. BITTNER, and REGINA HARRIS Jan. 1989 314 p
(Contract MDA903-86-C-0413)
(AD-A206201; ARI-RN-89-04) Avail: NTIS HC A14/MF A01 CSCL 05/9

This report describes the development and design specifications for a software-based aid for Army system designers. The purpose of the aid is to evaluate a system design by determining the operator and maintainer characteristics required by that design to reach criterion system performance levels. The aid is an analytical, simulation-based approach that will predict the impact on total system performance of individual differences in cognitive and psychomotor performance and of new system technologies. The specification describes a system based on the Human Operator Simulator (HOS) 4. In this approach, HOS performance micromodels are to be built from the Army Research Institute's (ARI) Project A predictor data. Although the design specification described herein is not being developed any further by ARI, it may prove useful for other projects. GRA

N89-24049# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
HUMAN-MACHINE INTERACTION CONSIDERATIONS FOR INTERACTIVE SOFTWARE Final Technical Report
LEN BASS and JOELLE COUTAZ (Grenoble-1 Univ., France) Feb. 1989 117 p
(Contract F19628-85-C-0003)
(AD-A206574; CMU/SEI-89-TR-4; ESD-TR-89-04) Avail: NTIS HC A06/MF A01 CSCL 23/2

This document introduces current concepts and techniques relevant to the design and implementation of user interfaces. A user interface refers to those aspects of a system that the user refers to, perceives, knows and understands. A user interface is implemented by code that mediates between a user and a system. This document covers both aspects. The first chapter is an introduction to the psychology of human-computer interaction. It presents the theoretical models that have had a significant impact on the evolution of the field. These models offer a way to organize the design process and help understand the cognitive process involved in interacting with a computer. The rest of the document is concerned with the software design of user interfaces and shows how the principles established by the cognitive principles can be put into practice. Following a presentation on the abstractions involved in the organization of an interactive system, attention is then directed to the tools for constructing user interfaces: windowing systems, tool kits and user interface management systems. GRA

N89-24050# Aerospatiale, Paris (France).
THE ROLE OF PILOT AND AUTOMATIC ONBOARD SYSTEMS IN FUTURE RENDEZVOUS AND DOCKING OPERATIONS
W. FEHSE, A. TOBIAS, A. GETZSCHMANN, M. CALDICHOURY, P. MAUTE, and M. ATTANASIO (Aerospatiale, Cannes La Bocca, France) 1988 13 p Presented at the 39th International Astronautical Federation Congress, Bangalore, India, 8-15 Oct. 1988 Previously announced in IAA as A89-17642
(REPT-882-440-116; IAF-88-037; ETN-89-94509) Avail: NTIS HC A03/MF A01

In the frame of a Hermes mission to service the Columbus module, an analysis of the role of pilots is presented. The discussion includes requirements, tasks to be performed onboard during rendezvous operations, the possibility of interaction by a pilot with an automatic guidance navigation and control system, and the necessary non-machine interfaces. Proposals for specific man machine interface displays and their arrangement in the cockpit are presented. The conclusion is that the pilot must have continuous access to all necessary information and must have the possibility to intervene at each point in time. ESA

N89-24354# Dornier-Werke G.m.b.H., Friedrichshafen (Germany, F.R.).
ECLS FOR COLUMBUS AND HERMES
H. PREISS, G. KRING, and R. SCHAEFER *In* ESA, International Symposium on Europe in Space: The Manned Space System p 163-167 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The environment control and life support subsystems (ECLS) of Hermes and Columbus are presented. The Hermes ECLS system has to ensure adequate working conditions for three persons during a 12 day mission. It includes atmosphere, liquids, food/galley, and waste management subsystems. The Columbus ECLS supports scientific experiments in an unmanned mode for 180 days, plus 7 days servicing with 2 persons. The ECLS functions for Columbus are mainly concerned with atmosphere control and conditioning. ESA

N89-24362# Elektronik-System G.m.b.H., Munich (Germany, F.R.).
MANNED INTERVENTIONS AT THE MTFF: CREW WORKLOAD ASPECTS
K. BRAMMER and GEORG KAMPFER (Panares, Munich, Germany, F.R.) *In* ESA, International Symposium on Europe in Space: The Manned Space System p 233-237 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The scenario of a Hermes visit to a Columbus MTFF and requirements with respect to crew activities for tending the MTFF subsystems and payload were investigated. An intervention concept is derived using a medium degree of automation, with exceptions to cater for optimal workflow, and frequent and time consuming tasks. It is concluded that a 7 day servicing period is required, with most of the difficulties arising from external servicing. The need to make payloads servicing-friendly is stressed. ESA

N89-24387# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
GETTING READY FOR EVA
A. ACCENSI *In its* International Symposium on Europe in Space: The Manned Space System p 467-475 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The roles of astronauts and robots in space missions are discussed. The advantages of extravehicular activity (EVA) for complex and contingency tasks is considered. The history and status of EVA programs conducted by ESA are summarized. ESA

N89-24388# Dornier-Werke G.m.b.H., Friedrichshafen (Germany, F.R.).
EVA INFORMATION SYSTEM: A MODERN WORKSTATION IN SPACE
FRANZ PITTERMANN, PIERRE LARROQUE, and STEPHANE BERTHIER (Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France) *In* ESA, International Symposium on Europe in Space: The Manned Space System p 477-483 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Information and communication requirements for extravehicular activity (EVA) are identified. Man-machine interfaces for EVA are discussed, and the relative merits of astronauts and robots are compared. Technologies and techniques needed in an EVA workstation are considered, and it is argued that the required technologies exist and can be adapted to space conditions. ESA

N89-24392# LABEN Space Instrumentation and Systems, Milan (Italy). Advanced Research and Development Dept.
ADVANCED MMI AND IMAGE HANDLING TO SUPPORT CREW ACTIVITIES
R. CORTINOVIS, B. BARNI, and R. PERSICO *In* ESA, International Symposium on Europe in Space: The Manned Space System p 509-514 Oct. 1988
Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

A concept for a crew workstation, focusing on man-machine interface (MMI) aspects related to the integrated handling of text, graphics, and visual information is presented. Window and overlay management methods, and image processing techniques for picture quality enhancement are discussed. ESA

N89-24792*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.
HUMAN FACTORS IN AUTOMATED AND ROBOTIC SPACE SYSTEMS: PROCEEDINGS OF A SYMPOSIUM. PART 1
THOMAS B. SHERIDAN, ed., DANA S. KRUSER, ed., and STANLEY DEUTSCH, ed. 1987 475 p Symposium held in Washington, DC, 29-30 Jan. 1987
(Contract NASW-4071)
(NASA-CR-182495; NAS 1.26:182495) Avail: NTIS HC A20/MF A01 CSCL 05/8

Human factors research likely to produce results applicable to the development of a NASA space station is discussed. The particular sessions covered in Part 1 include: (1) system productivity -- people and machines; (2) expert systems and their use; (3) language and displays for human-computer communication; and (4) computer aided monitoring and decision making. Papers from each subject area are reproduced and the discussions from each area are summarized. A.D.

N89-24793*# McDonnell-Douglas Astronautics Co., Huntsville, AL.
THE HUMAN ROLE IN SPACE (THURIS) APPLICATIONS STUDY. FINAL BRIEFING
GEORGE W. MAYBEE Oct. 1987 73 p
(Contract NAS8-36638)
(NASA-CR-183590; NAS 1.26:183590; MDC-W5125-2) Avail: NTIS HC A04/MF A01 CSCL 05/8

The THURIS (The Human Role in Space) application is an iterative process involving successive assessments of man/machine mixes in terms of performance, cost and technology to arrive at an optimum man/machine mode for the mission application. The process begins with user inputs which define the mission in terms of an event sequence and performance time requirements. The desired initial operational capability date is also an input requirement. THURIS terms and definitions (e.g., generic activities) are applied to the input data converting it into a form which can be analyzed using the THURIS cost model outputs. The cost model produces tabular and graphical outputs for determining the relative cost-effectiveness of a given man/machine mode and generic activity. A technology database is provided to enable assessment of support equipment availability for selected man/machine modes. If technology gaps exist for an application, the database contains information supportive of further investigation into the relevant technologies. The present study concentrated on testing and enhancing the THURIS cost model and subordinate data files and developing a technology database which interfaces directly with the user via technology readiness displays. This effort has resulted in a more powerful, easy-to-use applications system for optimization of man/machine roles. Volume 1 is an executive summary. A.D.

N89-24794*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.
HUMAN FACTORS IN AUTOMATED AND ROBOTIC SPACE SYSTEMS: PROCEEDINGS OF A SYMPOSIUM. PART 2
14 Aug. 1987 446 p Symposium held in Washington, DC, 29-30 Jan. 1987
(Contract NASW-4071)
(NASA-CR-182496; NAS 1.26:182496) Avail: NTIS HC A19/MF A01 CSCL 05/8

Human factors research likely to produce results applicable to the development of a NASA space station is discussed. The particular sessions covered in Part 2 include: (1) computer aided monitoring and decision making; (2) telepresence and supervisory control; (3) social factors in productivity and performance; and (4) the human role in space systems. Papers from each subject area are reproduced and the discussions from each area are summarized. A.D.

N89-24795*# McDonnell-Douglas Astronautics Co., Huntsville, AL.
THE HUMAN ROLE IN SPACE (THURIS) APPLICATIONS STUDY. VOLUME 2: RESEARCH ANALYSIS AND TECHNOLOGY REPORT
GEORGE W. MAYBEE Oct. 1987 273 p
(Contract NAS8-36638)
(NASA-CR-183589; NAS 1.26:183589; MDC-W5141-2-VOL-2)
Avail: NTIS HC A12/MF A01 CSCL 05/8

The THURIS (The Human Role in Space) application is an iterative process involving successive assessments of man/

machine mixes in terms of performance, cost and technology to arrive at an optimum man/machine mode for the mission application. The process begins with user inputs which define the mission in terms of an event sequence and performance time requirements. The desired initial operational capability date is also an input requirement. THURIS terms and definitions (e.g., generic activities) are applied to the input data converting it into a form which can be analyzed using the THURIS cost model outputs. The cost model produces tabular and graphical outputs for determining the relative cost-effectiveness of a given man/machine mode and generic activity. A technology database is provided to enable assessment of support equipment availability for selected man/machine modes. If technology gaps exist for an application, the database contains information supportive of further investigation into the relevant technologies. The present study concentrated on testing and enhancing the THURIS cost model and subordinate data files and developing a technology database which interfaces directly with the user via technology readiness displays. This effort has resulted in a more powerful, easy-to-use applications system for optimization of man/machine roles. Volume 2 presents a summary of the study objectives, approach, and results and technical discussion of accomplishments in the principal study tasks of: (1) sensitivity analysis, and (2) technology readiness database development. A summary of the study conclusions and recommendations is also presented. Author

N89-24796# IBM Watson Research Center, Yorktown Heights, NY.
EVALUATION, DESCRIPTION AND INVENTION: PARADIGMS FOR HUMAN-COMPUTER INTERACTION
JOHN M. CARROLL 16 Aug. 1988 25 p
(AD-A204617) Avail: NTIS HC A03/MF A01 CSCL 23/2

Human-Computer Interaction (HCI) is an urgent and rapidly developing area of computer science research and application. As it continues to evolve and to define itself, it is possible to identify distinct paradigms, or orientations to HCI research and application. Initially, HCI work focussed on empirical laboratory evaluation of computer systems and techniques. Subsequently, empirical studies of usability were organized by and addressed to cognitive theoretical description of user behavior and experience. Currently, the focus of HCI work is shifting toward a more directive role in invention, design and development of systems and techniques. The progression of these three paradigms comprises a case study of a field discovering what it is about, and more generally, of the variety of roles available in the psychology of technology. GRA

N89-24797*# Advanced Resource Development Corp., Columbia, MD.
BRAIN-WAVE MEASURES OF WORKLOAD IN ADVANCED COCKPITS: THE TRANSITION OF TECHNOLOGY FROM LABORATORY TO COCKPIT SIMULATOR, PHASE 2 Final Report
RICHARD L. HORST, DAVID L. MAHAFFEY, and ROBERT C. MUNSON Washington NASA 1989 187 p
(Contract NAS1-18019)
(NASA-CR-4240; NAS 1.26:4240) Avail: NTIS HC A09/MF A01 CSCL 05/8

The present Phase 2 small business innovation research study was designed to address issues related to scalp-recorded event-related potential (ERP) indices of mental workload and to transition this technology from the laboratory to cockpit simulator environments for use as a systems engineering tool. The project involved five main tasks: (1) Two laboratory studies confirmed the generality of the ERP indices of workload obtained in the Phase 1 study and revealed two additional ERP components related to workload. (2) A task analysis' of flight scenarios and pilot tasks in the Advanced Concepts Flight Simulator (ACFS) defined cockpit events (i.e., displays, messages, alarms) that would be expected to elicit ERPs related to workload. (3) Software was developed to support ERP data analysis. An existing ARD-proprietary package of ERP data analysis routines was upgraded, new graphics routines were developed to enhance interactive data analysis, and routines were developed to compare alternative single-trial analysis techniques using simulated ERP data. (4) Working in conjunction with NASA Langley research scientists and simulator engineers, preparations were made for an ACFS validation study of ERP measures of workload. (5) A design specification was developed for a general purpose, computerized, workload assessment system that can function in simulators such as the ACFS. Author

N89-24798*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DISPLAY-BASED COMMUNICATIONS FOR ADVANCED TRANSPORT AIRCRAFT
ALFRED T. LEE May 1989 24 p
(NASA-TM-102187; A-89118; NAS 1.15:102187) Avail: NTIS HC A03/MF A01 CSCL 12/1

The next generation of civil transport aircraft will depend increasingly upon ground-air-ground and satellite data link for information critical to safe and efficient air transportation. Previous studies which examined the concept of display-based communications in addition to, or in lieu of, conventional voice transmissions are reviewed. A full-mission flight simulation comparing voice and display-based communication modes in an advanced transport aircraft is also described. The results indicate that a display-based mode of information transfer does not result in significantly increased aircrew workload, but does result in substantially increased message acknowledgment times when compared to conventional voice transmissions. User acceptance of the display-based communication system was generally high, replicating the findings of previous studies. However, most pilots tested expressed concern over the potential loss of information available from frequency monitoring which might result from the introduction of discrete address communications. Concern was expressed by some pilots for the reduced time available to search for conflicting traffic when using the communications display system. The implications of the findings for the design of display-based communications are discussed. Author

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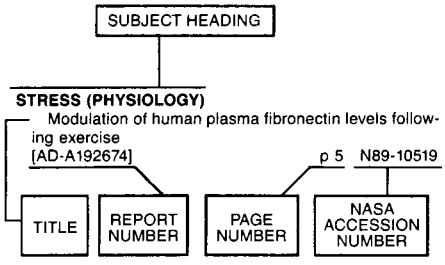
SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A89-43425
EXTRATERRESTRIAL AMINO ACIDS IN CRETACEOUS/TERTIARY BOUNDARY SEDIMENTS AT STEVNS KLINT, DENMARK
MEIXUN ZHAO and JEFFREY L. BADA (California, University, La Jolla) Nature (ISSN 0028-0836), vol. 339, June 8, 1989, p. 463-465. Research supported by the University of California and U.S. Navy. refs

The K/T boundary sediments at Stevns Klint, Denmark, are found to contain both alpha-amino-isobutyric acid and racemic isovaline. These two amino acids are exceedingly rare on the earth but are major amino acids in carbonaceous chondrites. An extraterrestrial source is the most reasonable explanation for the presence of these amino acids. C.D.

Typical Subject Index Listing



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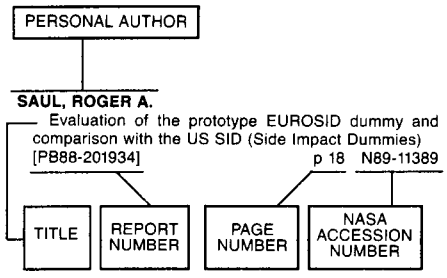

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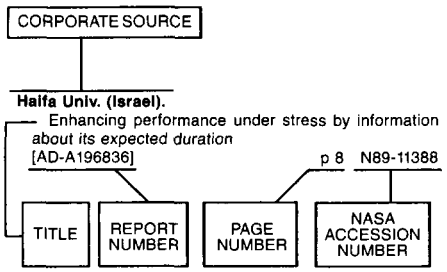

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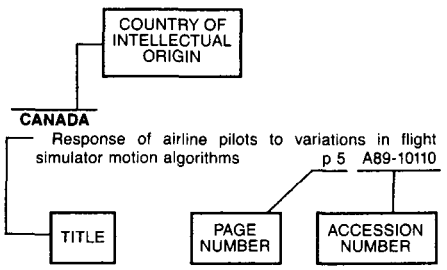

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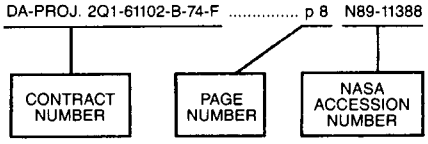

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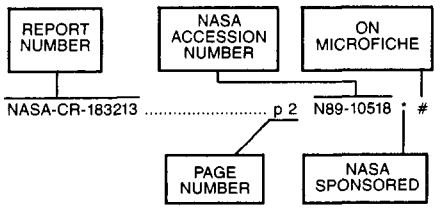

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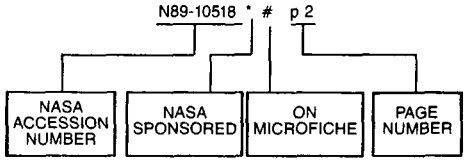

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